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### (54) FLOOR COVERING, CONSISTING OF HARD FLOOR PANELS AND METHOD FOR MANUFACTURING SUCH FLOOR PANELS

BODENBELAG, BESTEHEND AUS HARTEN BODENPLATTEN UND VERFAHREN ZUR HERSTELLUNG SOLCHER BODENPLATTEN

REVETEMENT DE SOL COMPOSE DE PANNEAUX DE PLANCHER DURS ET PROCEDE DE FABRICATION DE CES PANNEAUX DE PLANCHER

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(73) Proprietor: **Unilin Beheer B.V.**  
**2913 LV Nieuwerkerk aan de IJssel (NL)**

(72) Inventors:  

- **MORIAU, Stefan, Simon, Gustaaf**  
**B-9000 Gent (BE)**

• **CAPPELLE, Mark, Gaston, Maurits**  
**B-8840 Staden (BE)**  
 • **THIERS, Bernard; Paul, Joseph**  
**B-8780 Oostrozebeke (BE)**

(74) Representative: **Donné, Eddy**  
**Bureau M.F.J. Bockstaal nv**  
**Arenbergstraat 13**  
**2000 Antwerpen (BE)**

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**Description**

**[0001]** This invention relates to a floor covering, consisting of hard floor panels, as well as to a method for manufacturing such floor panels.

**[0002]** In first instance, the invention is intended for so-called laminated floors, but generally it can also be applied for other kinds of floor covering, consisting of hard floor panels, such as veneer parquet, prefabricated parquet, or other floor panels which can be compared to laminated floor.

**[0003]** It is known that such floor panels can be applied in various ways.

**[0004]** According to a first possibility, the floor panels are attached at the underlying floor, either by glueing or by nailing them on. This technique has as a disadvantage that it is rather complicated and that subsequent changes can only be made by breaking out the floor panels.

**[0005]** According to a second possibility, the floor panels are installed loosely onto the underground, whereby the floor panels mutually match into each other by means of a tongue and groove coupling, whereby mostly they are glued together in the tongue and groove, too. The floor obtained in this manner, also called a floating parquet flooring, has as an advantage that it is easy to install and that the complete floor surface can move which often is convenient in order to receive possible expansion and shrinkage phenomena.

**[0006]** A disadvantage with a floor covering of the above-mentioned type, above all, if the floor panels are installed loosely onto the underground, consists in that during the expansion of the floor and its subsequent shrinkage, the floor panels themselves can drift apart, as a result of which undesired joints can be formed, for example, if the glue connection breaks.

**[0007]** In order to remedy this disadvantage, techniques have already been thought of whereby connection elements made of metal are provided between the single floor panels in order to keep them together. Such connection elements, however, are rather expensive in manufacturing them and, furthermore, their provision or the installation thereof is a time-consuming occupation.

**[0008]** Examples of embodiments which apply such metal connection elements are described, among others, in the documents WO 94/26999 and WO 93/13280.

**[0009]** Furthermore, couplings are known which allow to snap floor parts into each other, a.o. from the documents WO 94/1628, WO 96/27719 and WO 96/27721. The snapping-together effect obtained with these forms of embodiment, however, does not guarantee a 100-percent optimum counteraction against the development of gaps between the floor panels, more particularly, because in fact well-defined plays have to be provided in order to be sure that the snapping-together is possible.

**[0010]** From GB 424.057, a coupling for parquetry parts is known which, in consideration of the nature of

the coupling, only is appropriate for massive wooden parquetry.

**[0011]** Furthermore, there are also couplings for panels known from the documents GB 2.117.813, GB 2.256.023 and DE 3.544.845. These couplings, however, are not appropriate for connecting floor panels.

**[0012]** US-A-4 426 820 discloses components for assembling a sports ground (surface) preferably from plastics material. Such a floor covering consists of hard floor panels comprising a core, the panels being intended to be laid to provide an upwardly facing, flat surface lying in a first horizontal plane and a downwardly facing, substantially flat surface lying in a second horizontal plane. The panels are provided, at least at the edges of two

opposite sides, with coupling parts formed in one piece with the core and cooperating with each other substantially in the form of a tongue and a groove. The groove is at least partially delimited by an upper lip and a lower lip, whereby the lower lip extends beyond the upper lip.

**[0013]** The coupling parts are provided with integrated mechanical locking means which prevent the drifting apart of two coupled panels in a direction perpendicular to the related edge and parallel to the underside of the coupled floor panels. The coupling means of US-A-4 426 820 are however not apt for use in thin hard flooring panels such as wood-based laminated flooring panels.

**[0014]** The invention aims at an improved floor covering of the aforementioned type, the floor panels of which can be coupled to each other in an optimum manner and/or the floor panels of which can be manufactured in a smooth manner, and whereby preferably one or more of the aforementioned disadvantages are excluded.

**[0015]** Furthermore, the invention also aims at a floor covering which shows the advantage that no mistakes during installing, such as gaps and such, can be created.

**[0016]** To this aim the invention relates to a floor covering, consisting of hard floor panels comprising a wood-based core, which panels are intended to be laid to provide an upwardly facing, flat surface lying in a first horizontal plane and a downwardly facing, substantially flat surface lying in a second horizontal plane, said hard floor panels being provided, at least at the edges of two opposite sides, with coupling parts formed in one piece with said wood-based core and cooperating with each

other, substantially in the form of a tongue and a groove, said groove being at least delimited by an upper lip terminating at a vertical plane and lower lip, and said tongue having a tongue portion extending from the tongue tip inwardly up to said vertical plane when said panels are joined, wherein :

- the lower lip is elastically bendable and extends beyond the upper lip;

- the coupling parts are provided with integrated mechanical locking means made in one piece with said core which prevent the drifting apart of two coupled floor panels in a direction perpendicular to the related edge and parallel to the underside of the coupled floor panels;
- said integrated mechanical locking means comprise on the one hand a protrusion located on the lower surface of said tongue, said protrusion extending at least partially beyond said vertical plane inwardly and said protrusion having a contact surface, and on the other hand a recess in the lower lip for accommodating said protrusion, said recess having a contact surface cooperating with said contact surface of said protrusion such that a tangent line which is defined by said contact surfaces when contacting each other is inclined with respect to said horizontal planes;
- said contact surface of the lower lip is located at least partially in the portion of the lower lip extending beyond the upper lip; and
- said protrusion, recess and elastically bendable lower lip are arranged to permit joining of said panels by shifting them with respect to each other in a substantially planar fashion.

**[0017]** In a first important preferred form of embodiment, the coupling parts are provided with locking means which, in the engaged position of two or more of such floor panels, exert a tension force upon each other which forces the floor panels towards each other. As a result of this is effected that not only during installing the formation of gaps is counteracted, but also in a later stage the development of gaps, as a result of which causes whatsoever, is counteracted.

**[0018]** According to a second important preferred form of embodiment, the aforementioned optimization consists in that the floor covering shows the following combination of characteristics: that the coupling parts and locking means, as mentioned above, are realized in one piece with the core of the floor panels; that the coupling parts have such a shape that two subsequent floor panels can be engaged into each other exclusively by snapping together and/or turning, whereby each subsequent floor panel can be inserted laterally into the previous; that the coupling parts provide in an interlocking, free from play, according to all directions in the plane which is situated perpendicular to the aforementioned edges; that the possible difference between the upper and lower lip of the lips which border the aforementioned groove, measured in the plane of the floor panel and perpendicular to the longitudinal direction of the groove, is smaller than one time the total thickness; that the total thickness of each related floor panel is larger than or equal to 5 mm; and that the basic material of the floor panels, or which the aforementioned core and locking means are formed, consists of a ground product which, by means of a binding agent or by means of melting to-

gether, is composed to a single compound, and/or of a chip board with fine chips.

**[0019]** Due to the fact that the coupling parts provide for an interlocking free from play, as well as due to the fact that these coupling parts are manufactured in one piece, from the basic material of the floor panels, a perfect connection between adjacent floor panels can always be guaranteed, even with repeated expansion and shrinkage of the floor surface.

**[0020]** This combination of characteristics can be combined or not with the aforementioned characteristic which states that the locking means exert a tension force upon each other.

**[0021]** According to a preferred form of embodiment, the floor panels consist of elongated panels and the coupling parts described above are applied at two opposite sides of these panels.

**[0022]** According to a particular form of embodiment, coupling parts are provided at the other two sides, too, either of another construction than described above or not.

**[0023]** In the most preferred form of embodiment, for the basic material use shall be made of the aforementioned product, which, as said, is ground and, by means of a binding agent, composed to a single compound. More particularly, for the core use shall be made of finely-ground wood which preferably is glued, more particularly, watertight glued. Still more particularly, for the core use shall be made of so-called HDF board (High Density Fibreboard) or MDF board (Medium Density Fibreboard).

**[0024]** The fact that the invention is applied to floor panels the basic material of which consists of the material described above, offers the advantage that with the processing of this material, very smooth surfaces are obtained whereby very precise couplings can be realized, which, in first instance, is important in the case of a snap-together connection and/or turning connection free from play. Also, very special forms of coupling parts can be manufactured in a very simple manner because the aforementioned kinds of material can be processed particularly easy.

**[0025]** The surfaces obtained with HDF and MDF also have the advantage that the floor panels mutually can fluently be shifted alongside each other in interlocked condition, even when engaged with a tensioning force.

**[0026]** The inventor also found out that the aforementioned materials, in particular HDF and MDF, show ideal features in order to realize a connection, such as mentioned above, as these materials show the right features in respect to elastic deformation in order to, on one hand, realize a snap-together effect, and, on the other hand, receive expansion and shrinkage forces in an elastic manner, whereby it is avoided that the floor panels come unlocked or are damaged in an irreparable manner.

**[0027]** The floor covering preferably is formed by joining the floor panels into each other free of glue. Hereby,

the connections are of such nature that the floor panels can be disassembled without being damaged, such that, for example, when moving, they can be taken along in order to be placed again. It is, however, clear that a glueing between tongue and groove is not excluded.

**[0028]** The invention, of course, also relates to floor panels which allow the realization of the aforementioned floor covering.

**[0029]** The invention also relates to a method for the manufacturing of the aforementioned floor panels which shows the advantage that the tongues and/or grooves, including the corresponding locking means, can be provided at the floor panels at high production speeds without problems. More particularly, it aims at a method which allows that the rather complicated forms of the tongue and the groove of the aforementioned floor panels can be realized completely by means of milling cutters, the diameter of which can be chosen independently of the form to be realized, such that the use of small milling cutters, for example finger cutters, with diameters smaller than the depth of the tongue or groove can be excluded.

**[0030]** To this aim, this method shows the characteristic that the tongue and/or groove is realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters which are positioned in different angles in respect to the related floor panel. During each of the aforementioned milling cycles, preferably substantially the final form of one flank, either of the tongue or of the groove, is realized.

**[0031]** For the aforementioned two milling cycles, thus, milling cutters are used which extend outside the groove, respectively the tongue. More particularly the diameters of these milling cutters shall at least be 5 times and even better 20 times larger than the thickness of the floor panels.

**[0032]** The use of milling cutters showing the aforementioned diameters has as an advantage that the normal production speeds can be maintained which are also applied during milling of a classical straight tongue and groove. There is also the advantage obtained that the installation of such milling cutters induce only minor or no additional costs because such milling cutters can be placed directly upon a motor shaft and/or the usual machines can be used.

**[0033]** Other important features of the invention are represented in the dependent claims.

**[0034]** With the intention of better showing the characteristics according to the invention, in the following, as an example without any limitative character, several preferred forms of embodiment are described, with reference to the accompanying drawings. It is to be noted that the coupling parts illustrated in figures 2-4 and 8-11 do not fall within the scope of claim 1.

**[0035]** In the drawings:

figure 1 represents a floor panel of a floor covering according to the invention;

5 figure 2, on a larger scale, represents a possible cross-section according to line II-II in figure 1; figures 3 and 4 represent how two floor panels with coupling parts according to figure 2 match into each other;

10 figure 5, on a larger scale, represents a cross-section according to line V-V in figure 1;

figures 6 and 7 represent how two floor panels with coupling parts according to figure 5 match into each other;

15 figures 8 to 11 represent a number of variants of coupling parts which can be applied in floor panels according to the invention;

20 figure 12 schematically represents how the floor parts can be provided with coupling parts;

25 figure 13 represents a cross-section according to line XIII-XIII in figure 12;

figures 14 to 21, on a larger scale and in cross-section, represent the penetration of the milling cutters which are indicated in figure 12 with arrows F14 to F21;

30 figure 22 represents a floor panel according to the invention;

35 figure 23, on a larger scale, represents the coupling of two floor panels of figure 22;

40 figures 24 and 25 represent two manners of coupling floor panels according to figure 22 to each other.

**[0036]** The invention relates to a floor covering which is composed of hard floor panels 1, for example, such as shown in figure 1.

**[0037]** These floor panels 1 can be of various shape, for example, rectangular or square, or of any other shape.

**[0038]** In the most preferred form of embodiment, they shall be manufactured in an elongated form, such as shown in figure 1, for example, with a length of 1 to 2 meters. The thickness, however, can also vary, but is preferably 0,5 to 1,5 cm, and more particularly 0,8 cm.

**[0039]** Each floor panel 1 is at least at the edges of two opposite sides provided with coupling parts which allow that two adjacent floor panels 1 can be coupled to each other.

**[0040]** Preferably all four edges are provided with coupling parts. In such case, the coupling parts at each pair of opposite edges may be of the same or of different kind.

**[0041]** Consequently, the coupling parts at two opposite edges show all features of claim 1, whereas the coupling parts at the other two edges need not show these features.

**[0042]** As will be clear from the further description, not all embodiments represented in the drawings show all features of appended claim 1. It is clear that in such cases these embodiments relate to coupling parts which can be used in combination with the embodiments corresponding to claim 1, for example in the manner as ex-

plained in the preceding paragraph.

[0043] In figure 1, the opposite sides 2-3 are provided with coupling parts 4-5.

[0044] The coupling parts 4-5, as represented in the figures 2 to 4, are provided with integrated mechanical locking parts 6 which prevent the drifting apart of two coupled floor panels 1 into a direction D perpendicular to the respective sides 2-3 and parallel to the underside 7 of the coupled floor panels 1; the coupling parts 4-5 and the locking means 6 are realized in one piece with the core 8 of the floor panels 1; the coupling parts 4-5 have such a shape that two subsequent floor panels 1 can be engaged into each other exclusively by snapping-together and/or turning, whereby each subsequent floor panel 1 can be laterally inserted into the previous; and the coupling parts 4-5 preferably provide in an interlocking free from play according to all directions in the plane which is situated perpendicular to the aforementioned edges.

[0045] In the case of floor panels 1 with an elongated shape, as represented in figure 1, the respective coupling parts 4-5 are situated at the longitudinal sides 2-3.

[0046] The coupling parts 4-5 can be realized in various forms, although the basic forms thereof will always be formed by a tongue 9 and a groove 10.

[0047] In the form of embodiment of figures 2 to 4, the related floor panel 1 is provided with coupling parts 4-5 and locking means 6 which allow to mutually engage two floor panels 1 by means of a turning movement, without the occurrence of any snap-together effect.

[0048] In the represented example, the locking means 6 consist of a first locking element 11, formed by a protrusion with a bent round shape at the lower side 12 of the tongue 9, and a second locking element 13, formed by a recess with a bent hollow shape in the lower wall 14 of the groove 10.

[0049] The locking elements 11-13 provide for that two floor panels 1 which are coupled to each other can not perform a lateral movement in the horizontal plane in respect to each other.

[0050] In order to obtain that two floor panels 1 can be inserted into each other by means of a turning movement, the curvatures preferably are circle-shaped. The bottom side 12 has a curvature with a radius R1, the center of which coincides with the related upper edge 15 of the floor panel 1, whereas the lower wall 14 shows a curvature with a radius R2 which is equal to the radius R1, but whereby its center coincides with the related upper edge 16. Radii R1 and R2 may also be applied which are larger or smaller than the distance to the upper edge 15, 16 respectively, and/or which differ from each other in size.

[0051] The upper side 17 of the tongue 9 and the upper wall 18 of the groove 10 are preferably flat and preferably are situated in the horizontal plane.

[0052] The front sides 19 and 20 of the tongue 9 and the groove 10 of two interlocked floor panels 1 preferably do not fit closely against each other, such, that in

between an intermediate space 21 is created into which possible dust remainders or such can be pushed away by means of the tongue 9.

[0053] The tongue 9 and the groove 10 preferably have shapes which are complementary to each other, such that the tongue 9 in the engaged condition of two floor panels 1 precisely sits against the upper wall 18 and the lower wall 14 of the groove 10, whereby a pressure P, executed onto the upper lip 22, is received not only by this lip 22, but by the complete structure, because this pressure can be transmitted through the tongue 9 and the lower lip 23.

[0054] It is, however, clear that a number of minor deviations to these complementary forms can occur which, anyhow, have no or almost no effect upon the receipt and transmission of pressure forces. For example, a chamfer 24 and a recess 25 can be provided, as represented in figures 2 to 4, as a result of which is obtained that the subsequent floor panels 1 can easily be pushed into each other, such that no possible ridges or such render the good insertion difficult.

[0055] As represented in the figures 5 to 7, the floor panels 1 according to the invention can also, along the sides 26-27 which are at a right angle to the sides 2-3, be provided with coupling parts 28-29 which have locking means 30, too. The coupling parts 28-29 are also realized in the shape of a tongue 31 and a groove 32. Hereby, the locking means 30 do not have to be of the same nature as the locking means 6.

[0056] Preferably, at the sides 26-27 locking means are applied which allow for an engagement and interlocking by means of a translation movement T only, as represented in figures 6 and 7. To this aim, the locking means 30 consist of a snap-together connection with locking elements 33 and 34 which grip behind each other.

[0057] As represented in figures 5 to 7, the locking element 33 consists of a protrusion of the lower side 35 of the tongue 31 which can take place in a recess 36 in the lower wall 37 of the groove 32. The locking element 34 is formed by the upward directed part which limits the recess 36.

[0058] In this case, the locking elements 33-34 have contact planes 38-39 which are parallel to each other and preferably extend in an inclined manner, according to a direction which simplifies the snapping-together. The tangent line L which is determined by the contact planes 38-39, hereby forms an angle A with the underside 7 which is smaller than 90°.

[0059] The locking elements 33-34 preferably are provided with inclined portions 40 and 41 which, when engaging two floor panels 1, cooperate with each other in such a manner that the locking elements 33-34 can easily be pushed over each other until they grip behind each other by means of a snap-together effect.

[0060] The thickness W1 of the tongue 31 preferably is equal to the width W of the groove 32, such that the upper lip 42, when exerting a pressure P, is supported

by the tongue 31 which, in its turn, then is supported by the lower lip 43.

[0061] Analogous to the chamfer 24 and recess 25, a recess 44 and a chamfer 45 are provided also at the edges 28-29.

[0062] Finally it is to be noted that, according to the invention, the lower lip 43, as represented in figures 5 to 7, is longer than the upper lip 42.

[0063] It is noted that such a snap-together coupling can also be applied at the edges 2-3. Hereby, this can be a snap-together coupling analogous to these of figures 5 to 7, but this can also be a snap-together coupling whereby other forms of coupling parts are applied, for example, such as represented in figures 8 and 9. Contrary to the locking elements 33-34 which consist of rather local protrusions, in the forms of embodiment of figures 8 and 9 use is made of locking elements 46-47 which, in comparison to the total width B of the coupling, extend over a rather large distance.

[0064] In this case, the locking elements 46-47 are also provided at the lower side 12 of the tongue 9 and the lower wall 14 of the groove 10.

[0065] According to figure 8, the locking elements 46-47 have contact surfaces 48-49 which are at an angle with the plane of the floor panel 1. Hereby, a coupling is obtained which is interlocked in a particularly fixed manner.

[0066] As represented in figure 9, the locking elements 46-47 possibly can be realized in such a manner that substantially only a linear contact is obtained, for example, because the contact surfaces directed towards each other are realized with different curvatures.

[0067] The surfaces, directed towards each other, of the locking elements 46-47 hereby consist of bent surfaces. The tangent line L forms an angle A which is smaller than 90°, and even better is smaller than 70°.

[0068] Hereby, the locking element 46 preferably has two portions with a different curvature, on one hand, a portion 50 with a strong curvature and, on the other hand, a portion 51 with a weak curvature. The portion 50 with the strong curvature provides for the formation of a firm coupling. The portion 51 with the weak curvature allows that the coupling parts 4-5 can be brought into each other easily. The intermediate space S forms a chamber which offers space for dust and similar which, when engaging two floor panels 1, gets there eventually.

[0069] In the case of a snap-together connection, for example, a connection, such as represented in figures 7 to 9, preferably always the tongue 9-31 has a shape, thickening towards below, which can cooperate with a widened portion in the groove 10.

[0070] In figure 10, a variant is represented whereby at least at the height of the upper edges 15-16, a sealing material 52 is provided, as a result of which a watertight sealing can be guaranteed. This sealing material 52 may consist of a strip or covering which is provided previously at the floor panel 1, either at one or both upper edges 15-16.

[0071] In figure 11, a further variant is represented, whereby the locking means 6 are formed by an upward directed portion 53 at the tongue 9 which, as a result of a turning movement, is brought behind a downward-directed portion 54 at the upper wall 18. More particularly, this is obtained by realizing the upper side 17 and the upper wall 18 with a curvature R3, the center of which is situated at the edges 15-16, and realizing the lower side 12 and the lower wall 14 with a radius R4, the center of which is also situated at the upper edges 15 and 16, respectively. These radii R3-R4 can be chosen otherwise, too.

[0072] In general, according to the invention, the difference between, on one hand, the radius R1, R3 respectively, and, on the other hand, the radius R2, R4 respectively, preferably should not be larger than 2 mm.

[0073] It is also preferred that the center of these radii is situated inside the circle C1, C2 respectively, which extends with a radius R5 of 3 mm around the upper edge 15, 16 respectively, such as, for example, indicated in figure 2.

[0074] Finally is noted that, according to the invention, the lower lip 23-43, as represented in figures 2 to 7, can be realized longer than the upper lip 22-42. This has as an advantage that the coupling parts 4-5-28-29 can be realized in an easier manner by means of a milling cutter or such. Furthermore, this simplifies the engagement of two floor panels 1, because each subsequent floor panel 1 during installation can be placed upon the protruding lower lip 23-43, as a result of which the tongue 9-31 and the groove 10-32 automatically are positioned in front of each other.

[0075] The embodiments whereby the lower lip 23 is equal to or shorter than the upper lip 22, in their turn, offer the advantage that no protruding lip 23 remains at the extreme edge of the floor which might cause problems in the finishing.

[0076] In order to allow for a smooth assembly, in order to guarantee the necessary stability and firmness and in order to limit the quantity of material to be cut away, the difference E between the upper lip 22-42 and the lower lip 23-43, measured in the plane of the floor panel and perpendicular to the longitudinal direction of the groove 10, should preferably be kept smaller than one time the total thickness F of the floor panel 1. For stability's sake, normally this total thickness F shall never be less than 5 mm.

[0077] The small dimension of the difference E offers the advantage that the lower lip must not be strengthened by a reinforcement strip or the like.

[0078] According to a particular form of embodiment, the central line M1 through the tongue 9 and the groove 10 is situated lower than the center M2 of the floor panel 1, such, that the upper lip 22-42 is thicker than the lower lip 23-43. In first instance, this is essential in this kind of connections, because then it is the lower lip 23-43 which bends, such that the upper side of the floor panel 1 is kept free of possible deformations.

**[0079]** As explained in the introduction, for the core 8 a material is chosen from the following series:

- a ground product which, by means of a binding agent or by means of melting together, is composed to a single compound;
- chip board with fine chips.

**[0080]** The invention shows its usefulness, in first instance, preferably with laminated flooring, due to the reasons explained in the introduction.

**[0081]** As represented in the examples of the figures 2 to 11, such laminated flooring preferably consists of a core 8 made of MDF board, HDF board or similar, whereby at least at the upper side of this core 8 one or more layers of material are provided.

**[0082]** More particularly, it is preferred that the laminated flooring is provided with a decorative layer 55 and a protective top layer 56. The decorative layer 55 is a layer, impregnated with resin, for example, made of paper, which can be imprinted with a variety of patterns, such as a wood pattern, a pattern in the form of stone, cork, or similar or even with a fancy pattern. The protective top layer 56 preferably also consists of a layer saturated with resin, for example, melamine resin, made of a transparent material.

**[0083]** It is clear that still other layers can be applied, such as an intermediate layer 57 upon which the decorative layer 55 is provided.

**[0084]** Preferably, also a backing layer 58 shall be applied at the underside 7, forming a counterbalancing element for the top layers and, thus, guaranteeing the stability of the form of the floor panel 1. This backing layer 58 may consist of a material, for example paper, impregnated with a resin, for example, a melamine resin.

**[0085]** As represented schematically in figure 12, the tongue 9 and the groove 10, and preferably also the tongue 31 and the groove 32 are applied by means of a milling process. In the case that a profile has to be applied on all four sides, the floor panels 1 preferably shall be displaced by means of two perpendicular movements V1 and V2, whereby during the first movement profiles at two opposite edges are provided, in this case the longitudinal edges, by means of milling devices 59-60, whereas during the second movement profiles are provided at the other edges, in this case the small edges, by means of milling devices 61-62. During these processing, the floor panels 1 preferably are put with their decorative layer directed downward.

**[0086]** According to an important characteristic of the invention, each respective tongue 9-31 and groove 10-32 are realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters which are positioned at different angles in reference to the related floor panel 1.

**[0087]** This is illustrated in figures 13, 14 and 15, wherein it is represented how a groove 10 is realized by means of two milling cycles by means of two milling cut-

ters 63 and 64. Figures 16 and 17 represent how the tongue 9 is realized by means of milling cutters 65 and 66.

**[0088]** The figures 18-19 and 20-21 represent similar views showing how the groove 32 and the tongue 31 are realized by means of milling cutters 67-68 and 69-70, positioned at an angle.

**[0089]** During each of the aforementioned milling cycles, each time substantially the final shape of one flank is realized. For example, the milling cutter 63 of figure 14 determines the final shape of the lower flank 71 of the groove 10, whereas the milling cutter 64 determines the final shape of the upper flank 72.

**[0090]** As mentioned in the introduction, preferably milling cutters 63 to 72 shall be applied, having diameters G which are at least 5 times, and even better at least 20 times larger than the thickness F of the floor panels 1.

**[0091]** Apart of the mentioned milling cutters, preferably still other milling cutters are applied, for example, in order to remove a part of the material to be removed already during a first premachining cycle.

**[0092]** In the figures 22 to 25, a particularly preferred form of embodiment of a floor panel 1 according to the invention is represented. Hereby, the parts which are taken over from the foregoing forms of embodiment are indicated with corresponding references.

**[0093]** An important characteristic herein consists in that the coupling parts 4-5 are provided with locking means 6 which, in engaged condition, exert a tension force upon each other, as a result of which the engaged floor portions 1 are forced towards each other. As represented, this is realized preferably by providing the coupling parts with an elastically bendable portion, in this case the lip 43, which, in engaged condition, is at least partially bent and in this way creates a tension force which provides for that the engaged floor panels 1 are forced towards each other. The hereby resulting bending V, as well as the tension force K resulting herefrom, are indicated in the enlargement of figure 23.

**[0094]** In order to obtain that the tension force K results in pressing together the engaged floor panels 1, the bendable portion, in this case the lip 43, preferably is provided, as represented, with an inwardly inclined contact surface 73 which preferably can cooperate with a corresponding contact surface 74. These contact surfaces 73-74 are similar to the aforementioned contact surfaces 39-38 and also similar to the inclined portions of the lower lip of figures 5 to 7.

**[0095]** In the figures 2 and 5, the portions form complementary matching shapes; it is, however, clear that, by a modification, also a tension effect similar as in figure 23 can be realized.

**[0096]** Due to, on one hand, the contact under the angle A, and, on the other hand, the fact that a tension force K is created, a force component K1 is effected, as a result of which the floor panels 1 are drawn against each other.

**[0097]** Preferably, the angle A of the contact surfaces

73-74 in respect to the horizontal plane is situated between 30 and 70 degrees. In first instance in the case that use is made of the embodiment whereby a tension force K is realized, an angle A of 30 to 70 degrees is ideal in order, on one hand, to effect an optimum pressing-together of the floor panels 1 and, on the other hand, to obtain that the floor panels 1 can easily be engaged, respectively disassembled.

**[0098]** Although the pressing force K1 preferably is delivered by the aforementioned lip 43, the invention does not exclude other forms of embodiment whereby this force is delivered by other bendable portions.

**[0099]** It is noted that the bending V is relatively small, for example, several hundredths up to several tenths of a millimeter, and does not have an influence upon the placement of the floor covering. Furthermore is noted that such floor covering generally is placed upon an underlayer which is elastically compressible, as a result of which the bending V of the lip 43 exclusively results in the fact that the underlayer locally is compressed somewhat more.

**[0100]** Due to the fact that the lip 43 is bent apart and that it remains somewhat bent apart in engaged position, also the advantage is effected that, when exerting a pressure upon the floor covering, for example, when placing an object thereupon, the pressing-together force is enhanced and, thus, the development of gaps is counteracted even more.

**[0101]** It is noted that the inventor has found that, contrary to all expectations, an ideal tension force can be realized by manufacturing the coupling parts 4-5, including the locking elements 33-34, and preferably the complete core 8, of HDF board or MDF board, although these materials only allow a minor elastic deformation.

**[0102]** HDF and MDF also offer the advantage that smooth surfaces are obtained, as a result of which the locking elements can be moved easily over each other.

**[0103]** According to a variant of the invention, the tension force can also be delivered by means of an elastic compression of the material of the coupling parts, to which end these coupling parts, and preferably the complete core 8, then have to be manufactured in an elastically compressible material.

**[0104]** A further particular characteristic of the embodiment of figures 22 to 25 consists in that the floor panels 1 can be engaged by means of a turning movement, as represented in figure 24, as well as by means of shifting them towards each other, as represented in figure 25, preferably in such a manner that, during the engagement by means of the turning movement, a maximum bending Vm results in the coupling parts, more particularly in the lip 43, which bending Vm is less pronounced, if not non-existent, as in the figures 2 to 4, in comparison to the bending Vm which results when the floor panels 1 are engaged by means of shifting them towards each other.

**[0105]** The advantage of this consists in that the floor panels 1 can be engaged easily by means of a turning

movement, in other words by means of the angling down or pivoting thereof, without necessitating a tool therefore, whereas it still remains possible to engage the floor panels also by means of shifting them. This latter is useful,

5 in first instance, when the last panel has to be placed partially under a door frame or similar. In this case, the floor panel 1 can be pushed under the door frame with the side which does not have to be engaged and subsequently, possibly by means of tools, can be snapped into the adjacent floor panel 1.

**[0106]** It is noted that the shapes of the coupling parts 4-5 shown in figures 22 to 25 can also be used for the coupling parts 28-29 of the short sides.

**[0107]** According to the invention, in the case that the four sides 2-3-26-27 are provided with coupling parts 4-5-28-29, these coupling parts can be realized in such a manner that in one direction a firmer engagement than in the other direction is effected. In the case of elongated floor panels 1, for example, such as represented in figure 1, the locking at the small sides 26-27 preferably shall be more pronounced than at the longitudinal sides 2-3. The length of the coupling at the small sides, namely, is smaller and, in principle, less firm. This is compensated by providing in a more pronounced locking.

**[0108]** This difference in engagement can be obtained by realizing the contact surfaces 73-74 under different angles.

**[0109]** Preferably, the aforementioned protrusion, more particularly the locking element 33, is bordered by 30 at least two portions 75-76, respectively a portion 75 with a strong inclination which provides for the locking, and a portion 76 with a weaker inclination which renders the engagement of the coupling parts easier. In the embodiment of figures 22 to 25, these portions 75-76 are 35 formed by straight planes, but, as already described in reference to figure 9, use can also be made of curved portions 50-51. In figure 5, these are the contact surface 38 and the inclined portion 40.

**[0110]** In the preferred form of embodiment, the floor 40 panels 1 according to the invention comprise coupling parts 4-5 and/or 28-29 showing one of the following or the combination of two or more of the following features:

- a curvature 77 at the lower side of the tongue 9 and/or a curvature 78 at the lip 43 which form a guidance when turning two floor panels 1 into each other, with the advantage that the floor panels 1 can be engaged into each other easily during installing;
- roundings 79-80 at the edges of the locking elements 33-34, with the advantages that the locking elements can easily shift over each other during the engagement, respectively disassembly of the floor panels 1 and that the locking elements are not damaged, for example, crumble away at their edges, even if the floor panels are engaged, respectively disassembled, repeatedly;
- dust chambers 81, or spaces 21 as in figure 4, between all sides, directed laterally towards each oth-

er, of the engaged floor panels 1, with the advantage that inclusions which get between the floor panels 1 during the engagement do not exert a disadvantageous influence upon the good engagement;

- a shaping of the tongue 9 which is such, for example, by the presence of a chamfer 82, that the upper side of the tongue 9 already with the first contact becomes situated under the lower side of the upper lip 42 when the floor panels 1 are pushed towards each other at the same level, as indicated in figure 25, with the advantage that the front extremity of the tongue 9 does not press against the front side of the upper lip 42 when the floor panels are pushed towards each other at the same level;
- a ramp surface 83, hereinbefore also called inclined portion 41, formed at the free extremity of the lower lip 43, with the advantage that the locking elements 33-34 shift smoothly over each other and that the lower lip 43 is bent uniformly;
- in the engagement direction only one important contact point which is formed by a section 84 at the location of the top side of the floor panels 1, with the advantage that the aforementioned tension force is optimally transferred to the upper side of the floor panels 1 and that the development of openings between the floor panels 1 is counteracted;
- contact surfaces 85-86, more particularly abutment surfaces, formed by the upper side of the tongue 9 and the upper side of the groove 10 which, over the largest portion of their length, run parallel to the plane which is defined by the floor panels 1, as well as contact surfaces cooperating with each other, formed by curvatures 77-78, with the advantage that no mutual displacement in height between two engaged floor panels 1 is possible, even if the insertion depth of the tongue 9 into the groove 10 should vary due to which causes whatsoever, in other words, that no height differences may occur between the adjacent floor panels.

[0111] In the form of embodiment of figures 22 to 25, all these characteristics are combined; it is, however, clear that, as becomes evident from figures 2 to 11, these features can also be present separately or in a limited combination.

[0112] As becomes evident from figures 5 to 7 and 22 to 25, an important characteristic of the embodiment of the invention consists in that the locking means 6, in other words, the portion providing for the snap-together and engagement effect, are situated in that portion of the lower lip 23-43 which extends beyond the upper lip 22-42, more particularly, that the lowermost point 87 of the locking part 33 is situated under the top layer of the floor panel 1. For clarity's sake, this top layer is indicated in the figures 22 to 25 only as a single layer.

[0113] It is noted that the combination of features, that the lower lip 23-43 extends further than the upper lip

22-42, that the locking means 6 are formed at least by means of a portion which inwardly slopes downward, and that this portion, at least partially, is located in the portion of the lower lip 23-43 which extends beyond the upper lip 22-42, is particularly advantageous, among others, in comparison with the couplings for floor panels described in the documents WO 94/01628, WO 94/26999, WO 96/27719 and WO 96/27721. The sloping portion offers the advantage that the floor panels 1

can be disassembled again. The fact that this sloping portion is situated in the further extending portion of the lower lip 23-43 additionally to this offers the advantage that no deformations can occur during coupling which manifest themselves up to the top layer.

[0114] According to a preferred characteristic of the invention, the aforementioned portion, i.e. the contact surface 39 or 73, preferably extends in such a manner that the distance up to the upper edge 16 diminishes from below in upward direction, in other words, such that, as represented in figure 22, the distance X2 is smaller than the distance X1. This is also the case in figure 7.

[0115] Still preferably, this portion only starts at a clear distance E1 from the upper lip 42.

[0116] It is obvious that the coupling parts 22 to 25 can also be realized by means of said milling process.

[0117] According to a particular characteristic of the invention, the floor panels 1 are treated at their sides 2-3 and/or 26-27 with a surface densifying agent, more particularly a surface hardening agent, which preferably is chosen from the following series of products: impregnation agents, pore-sealing agents, lacquers, resins, oils, paraffines and similar.

[0118] In figure 22, such impregnation 88 is represented schematically. This treatment can be performed over the complete surface of the sides 2-3 and/or 26-27 or only over well-defined portions hereof, for example, exclusively the surfaces of the tongue 9 and the groove 10.

[0119] The treatment with a surface densifying agent offers, in combination with the snap-together effect, the advantage that in various aspects better coupling features are obtained. As a result of this, the coupling parts 4-5 and/or 28-29 better keep their shape and strength, even if the floor panels 1 are engaged and disassembled repeatedly. Especially in the case that for the core 8 use is made of HDF, MDF or similar, by means of this treatment such a better quality of surface condition is obtained, that no abrasion of material occurs during engaging, respectively during disassembling.

[0120] This treatment also offers the advantage that, at least in the case of a surface hardening, the aforementioned elastic tensioning effect is enhanced.

[0121] The present invention is in no way limited to the forms of embodiment described by way of example and represented in the figures, however, can such floor covering and the pertaining floor panels 1 be realized in various forms and dimensions without leaving the scope of the invention.

[0122] For example, the various characteristics which are described by means of the represented forms of embodiment, may be combined with each other or not.

[0123] Furthermore, all embodiments of coupling elements described before can be applied at the longer side as well as at the shorter side.

## Claims

1. Floor covering, consisting of hard floor panels comprising a wood-based core, which panels (1) are intended to be laid to provide an upwardly facing, flat surface lying in a first horizontal plane and a downwardly facing, substantially flat surface lying in a second horizontal plane, said hard floor panels being provided, at least at the edges of two opposite sides (2-3, 26-27), with coupling parts (4-5, 28-29) formed in one piece with said wood-based core and cooperating with each other, substantially in the form of a tongue (9-31) and a groove (10-32), said groove being at least delimited by an upper lip (22-42) terminating at a vertical plane and lower lip (23-43), and said tongue having a tongue portion extending from the tongue tip inwardly up to said vertical plane when—said panels are joined, wherein :

- the lower lip (23-43) is elastically bendable and extends beyond the upper lip (22-42);
- the coupling parts are provided with integrated mechanical locking means (6) made in one piece with said core which prevent the drifting apart of two coupled floor panels in a direction perpendicular to the related edge and parallel to the underside of the coupled floor panels;
- said integrated mechanical locking means comprise on the one hand a protrusion (33) located on the lower surface (35) of said tongue, said protrusion extending at least partially beyond said vertical plane inwardly and said protrusion having a contact surface (38, 74), and on the other hand a recess (36) in the lower lip for accommodating said protrusion, said recess having a contact surface (39, 73) cooperating with said contact surface of said protrusion such that a tangent line (L) which is defined by said contact surfaces when contacting each other is inclined with respect to said horizontal planes;
- said contact surface (39, 73) of the lower lip is located at least partially in the portion of the lower lip (23-43) extending beyond the upper lip; and
- said protrusion (33), recess (36) and elastically bendable lower lip (23-43) are arranged to permit joining of said panels by shifting them with respect to each other in a substantially planar

fashion.

2. Floor covering according to claim 1, characterized in that the wood based core of the floor panels (1) comprises a ground wood product which, together with a binding agent is composed to a single compound and/or is made of chip board with fine chips.
3. Floor covering according to claim 1 or 2, characterized in that the wood based core of the floor panels (1) consists of HDF board or MDF board, whereby the coupling parts (4-5-28-29) and the locking means (6) are formed out of this board.
4. Floor covering according to any of the preceding claims, characterized in that at least the contact surface (39-73) at the lower lip (23-43) is inwardly inclined.
5. Floor covering according to any of the preceding claims, characterized in that both contact surfaces (38-39, 73-74) are inclined.
6. Floor covering according to any of the preceding claims, characterized in that said protrusion has a base extending along the lower surface (35) of said tongue over a considerable length.
7. Floor covering according to any of the preceding claims, characterized in that the thickness of the lower lip (23-43) increases from the deepest point of the recess towards the innermost point of the groove (10).
8. Floor covering according to any of the preceding claims, characterized in that the tongue (9-31) and groove (10-32) have a shape such that in coupled condition of two floor panels (1) there exists a chamber (81) between those sides of the protrusion and the recess (36) that are located opposite to the sides at which the contact surfaces (39-73) are formed.
9. Floor covering according to any of the preceding claims, characterized in that the coupling parts (4-5, 28-29) provide in an interlocking, allowing to couple the panels free from play in respect to each other, according to all directions in the plane which is situated perpendicular to the aforementioned edges.
10. Floor covering according to any of the preceding claims, characterized in that the locking means (6) are constructed such that upon exerting a pressure on top of a panel (1) nearby the edge which is provided with the tongue (9-31), these locking means (6) tend to press the floor panels (1) towards each other.

11. Floor covering according to any of the preceding claims, characterized in that there is a space (S, 81) between said protrusion and a portion of said lower lip (43), more particularly below said protrusion, allowing a further penetration of the protrusion in the recess, when necessary.
12. Floor covering according to any of the preceding claims, characterized in that both contact surfaces (12-14, 38-39, 74-73) are inclined and have corresponding inclinations.
13. Floor covering according to any of the preceding claims, characterized in that at least one of the contact surfaces (73-74) consists of an inclined flat surface preceded in the engaging direction of the tongue into the groove by a rounding (80-79) at an outer end of said inclined surface.
14. Floor covering according to any of the preceding claims, characterized in that the coupling parts (4-5, 28-29) have such a shape that two subsequent floor panels (1) can be engaged into each other by shifting them laterally together as well as by turning.
15. Floor covering according to any of the preceding claims, characterized in that the distance (E) by which the lower lip extends beyond the upper lip is smaller than one time the total thickness (F) of the floor panel (1).
16. Floor covering according to any of the preceding claims, characterized in that the total thickness (F) of each floor panel (1) is larger than or equal to 5 mm.
17. Floor covering according to any of the preceding claims, characterized in that the floor panels (1) consist of elongated panels and that, at least at their longitudinal sides (2-3), they are provided with the aforementioned coupling parts (4-5).
18. Floor covering according to any of the preceding claims, characterized in that the floor panels (1) are rectangular or square and that, on all four sides (2-3-26-27), more particularly two by two, they are provided with the aforementioned coupling parts (4-5-28-29).
19. Floor covering according to any of the preceding claims, characterized in that the coupling parts (4-5, 28-29) of at least two opposite sides (2-3, 26-27) are realized in such a manner that the floor panels (1) can be engaged by means of shifting them towards each other as well as by means of a turning movement, whereby, during the engagement by means of the turning movement, a bending can occur in the coupling parts (4-5 and/or 28-29), which
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- bending is less pronounced, if not non-existent, in comparison to the bending which occurs when the floor panels (1) are engaged by means of shifting them towards each other.
20. Floor covering according to any of the preceding claims, characterized in that the lower surface of the aforementioned protrusion is bordered by at least two portions (38-40, 75-76), respectively a portion (38-75) with a strong inclination providing for the locking effect, and a portion (40-76) with a weaker inclination which renders the engagement of the coupling parts (4-5) easier.
- 10 21. Floor covering according to any of the preceding claims, characterized in that the tangent line (L) forms an angle (A) with the underside (7) of the floor panels which is 30° to 70°.
- 15 22. Floor covering according to any of the preceding claims, characterized in that the locking means (6) are formed by locking elements (34) which are located completely in the portion of the lower lip (23-43) which extends beyond the upper lip (22-42), such that the lowermost point (87) of engagement of the locking elements (34) is located underneath the top layer of the floor panel (1) which carries the related tongue (9).
- 20 23. Floor covering according to any of the preceding claims, characterized in that the lower side of said tongue portion extending from the tongue tip inwardly is provided with a curvature (77).
- 25 24. Floor covering according to claim 23, characterized in that said curvature (77) allows the tongue (9) to be freely inserted into the groove (10) by means of a turning movement around the upper edge (16) of the floor panel (1) having the groove (10).
- 30 25. Floor covering according to any of the preceding claims, characterized in that there is a curvature (78) at the upper side of the lower lip (23-43) which forms a guidance when turning two floor panels (1) into each other.
- 35 26. Floor covering according to any of the preceding claims, characterized in that dust chambers or similar (21-44-81) are provided between all sides of the engaged floor panels (1) which are directed laterally towards each other.
- 40 27. Floor covering according to any of the preceding claims, characterized in that the shaping of the tongue (9-31) and/or the lower lip (43) are such that the floor panels (1) can be coupled by laterally shifting them towards each other, starting from a mutual position in which the floor panels (1) at the edges
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- to be coupled, are completely separated from each other.
28. Floor covering according to any of the preceding claims, characterized in that the upper side of the tongue tip already at the first contact with the upper lip (42) is located underneath the upper lip (42) when the floor panels (1) are shifted towards each other.
29. Floor covering according to any of the preceding claims, characterized in that the lower lip (43) at the free extremity thereof is provided with a ramp surface (41-83), said ramp surface (41-83) allowing that a first floor panel (1), when shifting it over the floor to a second floor panel (1), is guided with its protrusion over said ramp surface.
30. Floor covering according to any of the preceding claims, characterized in that in the engagement direction, apart from said contact surfaces (39-73) there exists only one substantial contact point between two coupled floor panels (1), which is formed by a section (84) at the location of the top side of the floor panels (1).
31. Floor covering according to any of the preceding claims, characterized in that said floor panels (1) are provided with contact surfaces (85-86), more particularly abutment surfaces, formed by the upper side of the tongue (9-31) and the upper side of the groove (10) which, over the largest portion of their length, run parallel to the plane which is defined by the floor panels (1).
32. Floor covering according to any of the preceding claims, characterized in that the lower lip (23-43) has a thickness which is smaller than the thickness of the upper lip.
33. Floor covering according to any of the preceding claims, characterized in that the lower lip (23-43) is more flexible than the upper lip (22-42).
34. Floor covering according to any of the preceding claims, characterized in that the underside of the upper lip (22-42) is provided with a chamfer (24-45).
35. Floor covering according to any of the preceding claims, characterized in that the contact surfaces (39-73) are located on radii (R1-R2) around the upper edges (15-16), the difference between these radii (R1-R2) being zero or not larger than 2 mm.
36. Floor covering according to any of the preceding claims, characterized in that the upper side of the lower lip (43) and/or the lower side (12) of the tongue shows a portion having a curvature substantially with a radius (R1, respectively R2), said curvature having a center which is located within the circle (C1, respectively C2) which extends with a radius (R5) of 3 mm around the upper edge (15-16) of the panel (1) concerned.
37. Floor covering according to any of the preceding claims, characterized in that the upper side of the upper lip (22-42) is in the same plane as the upper surface of the panel (1).
38. Floor covering according to any of the preceding claims, characterized in that the portion of the lower lip (23-43) located beyond the upper lip (22-42) is located completely below the level defined by the lower side of the upper lip (22-42).
39. Floor covering according to claim 38, characterized in that said portion of the lower lip is located completely below the central line M2 of the panel.
40. Floor covering according to any of the preceding claims, characterized in that the tongue (9) and groove (10) allow to couple the panels (1) by a turning movement around the upper edges (15-16) of the panels (1), whereby during this movement the tongue can freely be slid into the groove (10).
41. Floor covering according to any of the preceding claims, characterized in that the panels (1) have short sides and longer sides and in that the locking means (6) comprise contact surfaces which at the short sides have a stronger inclination than at the longer sides.
42. Floor covering according to any of the preceding claims, characterized in that the tongue (9-31) and the groove (10-32) have a profile which can be produced by milling, preferably by means of milling cutters having a diameter which is at least 20 times larger than the thickness (F) of the floor panels (1).
43. Floor covering according to claim 42, characterized in that the edges of the panels have a profile which can be milled in two milling actions.
44. Floor covering according to any of the preceding claims, characterized in that the lower lip has an inclined portion (39-73) which extends in such a manner that the distance (X1-X2) up to the upper edge (16) of the floor panel (1) diminishes from below in upward direction.
45. Floor covering according to any of the preceding claims, characterized in that the floor panels (1) are realized as laminated flooring, whereby on the core (8) one or more layers, among which a decorative layer (55) forming said decorative surface, are pro-

- vided and whereby a backing layer (58) is provided at the underside (7).
46. Floor covering according to any of claims 1 to 41 claims, characterized in that the coupling parts at their surface, in other words, the edges of the floor panels (1), are treated with a surface densifying agent, more particularly, a surface hardening agent. 5
47. Floor covering according to any of the preceding claims, characterized in that the floor panels (1) are connected free of glue, such that they can be disassembled and be re-used. 10
48. Floor panel for realizing a floor covering according to any of the claims 1 to 47. 15
49. Method for manufacturing floor panels as described in any of the preceding claims, characterized in that the tongue (9-31) and/or groove (10-32) is realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters (63-64-65-66-67-68-69-70) which are positioned in different angles in respect to the related floor panel (1). 20
50. Method according to claim 49, characterized in that during each of the aforementioned milling cycles each time substantially the final shape of one flank (71-72), either of the tongue or of the groove, is realized. 25
51. Method according to claim 49 or 50, characterized in that for the aforementioned two milling cycles milling cutters (63-64-65-66-67-68-69-70) are applied which extend outside the groove (10-32), respectively the tongue (9-31), and more particularly show diameters (G) which are at least 5 times larger than the thickness (F) of the floor panels (1), and preferably even at least 20 times larger than the thickness (F) of the floor panels (1). 30
52. Method according to any of the claims 49 to 51, characterized in that at all four sides of the floor panel (1) a profile is provided and that the floor panels (1) are displaced according to two perpendicular movements (V1-V2), whereby during one of the movements profiles at two opposite edges are provided, whereas during the other movement profiles are provided at the small edges. 35
- Patentansprüche
- Fußbodenbelag, bestehend aus harten Fußbodenpaneelen, die einen Kern auf Holzbasis umfassen, wobei diese Paneele (1) dazu bestimmt sind, verlegt zu werden, um eine nach oben weisende, fla- 55
- che Oberfläche zu bilden, die in einer ersten horizontalen Ebene liegt, und eine nach unten weisende, hauptsächlich flache Oberfläche, die in einer zweiten horizontalen Ebene liegt, wobei besagte harte Fußbodenpaneelle zumindest an den Kanten zweier einander gegenüberliegender Seiten (2-3, 26-27) mit Kupplungsteilen (4-5, 28-29) versehen sind, die einteilig mit besagtem Kern auf Holzbasis ausgebildet sind und miteinander zusammenwirken, hauptsächlich in Form einer Feder (9-31) und einer Nut (10-32), wobei besagte Nut zumindest durch eine obere Lippe (22-42), die an einer vertikalen Ebene endet, und eine untere Lippe (23-43) begrenzt wird, und wobei besagte Feder einen Federbereich aufweist, der sich von der Federspitze nach innen bis zu der besagten vertikalen Ebene erstreckt, wenn besagte Paneele zusammengefügt sind, wobei:
- die untere Lippe (23-43) elastisch verbiegbar ist und sich über die obere Lippe (22-42) hinaus erstreckt;
  - die Kupplungsteile mit integrierten mechanischen Verriegelungsmitteln (6) versehen sind, die einteilig mit besagtem Kern ausgebildet sind, die das Auseinanderschieben zweier zusammengefügter Paneele in einer Richtung rechtwinklig zur betreffenden Kante und parallel zur Unterseite der zusammengefügten Fußbodenpaneelle verhindern;
  - besagte integrierte mechanische Verriegelungsmittel einerseits einen Vorsprung (33) umfassen, der sich an der Unterseite (35) besagter Feder befindet, wobei besagter Vorsprung sich zumindest teilweise über besagte vertikale Ebene hinaus nach innen erstreckt und wobei besagter Vorsprung eine Kontaktfläche (38, 74) aufweist und andererseits eine Aussparung (36) in der unteren Lippe zur Aufnahme besagten Vorsprungs, wobei besagte Aussparung eine Kontaktfläche (39, 73) aufweist, die derart mit besagter Kontaktfläche besagten Vorsprungs zusammenwirkt, dass eine Tangente (L), die durch besagte Kontaktflächen definiert wird, wenn sie miteinander in Kontakt sind, in Bezug auf besagte horizontale Ebenen geneigt ist;
  - besagte Kontaktfläche (39, 73) der unteren Lippe zumindest teilweise in dem Bereich der unteren Lippe (23-43) liegt, der sich über die obere Lippe hinaus erstreckt; und
  - besagter Vorsprung (33), besagte Aussparung (36) und besagte elastisch verbiegbare untere Lippe (23-43) so angeordnet sind, dass sie ein Zusammenfügen besagter Paneele durch gegenseitiges Verschieben in einer hauptsächlich ebenenbezogenen Weise gestatten.

2. Fußbodenbelag gemäß Anspruch 1, dadurch gekennzeichnet, dass der Kern auf Holzbasis der Fußbodenpaneelle (1) ein gemahlenes Holzprodukt umfasst, das zusammen mit einem Bindemittel zu einer einzigen Zusammenstellung vermischt ist und/oder aus einer Spanplatte mit feinen Spänen besteht.
3. Fußbodenbelag gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, dass der Kern auf Holzbasis der Fußbodenpaneelle (1) aus HDF-Platte oder MDF-Platte besteht, wobei die Kupplungsteile (4-5-28-29) und die Verriegelungsmittel (6) aus dieser Platte geformt sind.
4. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass zumindest die Kontaktfläche (39-73) an der unteren Lippe (23-43) nach innen geneigt ist.
5. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass beide Kontaktflächen (38-39, 73-74) geneigt sind.
6. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass besagter Vorsprung eine Basis hat, die sich entlang der Unterseite (35) besagter Feder über eine beträchtliche Länge erstreckt.
7. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Dicke der unteren Lippe (23-43) vom tiefsten Punkt der Aussparung in Richtung auf den innersten Punkt der Nut (10) zunimmt.
8. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Feder (9-31) und die Nut (10-32) eine derartige Form haben, dass in zusammengefügtem Zustand von zwei Fußbodenpaneelen (1) eine Kammer (81) zwischen denjenigen Seiten des Vorsprungs und der Aussparung (36), die sich gegenüber von den Seiten befinden, an denen die Kontaktflächen (39-73) ausgebildet sind, vorhanden ist.
9. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Kupplungsteile (4-5, 28-29) für ein Ineinanderverriegeln sorgen, wobei sie ein spielfreies Zusammenfügen der Paneele in Bezug zueinander ermöglichen, gemäß allen Richtungen in der rechtwinklig zu den vorgenannten Kanten befindlichen Ebene.
10. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Verriegelungsmittel (6) so konstruiert sind, dass beim Ausüben eines Drucks auf ein Paneel (1) in Nähe
- der mit der Feder (9-31) versehenen Kante, diese Verriegelungsmittel (6) dazu neigen, die Fußbodenpaneelle (1) gegeneinander zu pressen.
- 5 11. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass ein Raum (S, 81) zwischen besagtem Vorsprung und einem Bereich besagter unterer Lippe (43), spezieller unter besagtem Vorsprung, vorhanden ist, der nötigenfalls ein weiteres Eindringen des Vorsprungs in die Aussparung gestattet.
- 10 12. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass beide Kontaktflächen (12-14, 38-39, 74-73) geneigt sind und entsprechende Neigungen aufweisen.
- 15 13. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass zumindest eine der Kontaktflächen (73-74) aus einer geneigten flachen Oberfläche besteht, der in der Eingriffsrichtung der Feder in die Nut eine Rundung (80-79) an einem äußeren Ende besagter geneigter Oberfläche vorangeht.
- 20 14. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Kupplungsteile (4-5, 28-29) eine solche Form haben, dass zwei aufeinanderfolgende Fußbodenpaneelle (1) sowohl durch seitliches Ineinanderschieben als auch durch Drehen ineinandergefügt werden können.
- 25 15. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass der Abstand (E), um den die untere Lippe über die obere Lippe hinausragt, kleiner ist als ein Mal die gesamte Dicke (F) des Fußbodenpaneels (1).
- 30 16. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die gesamte Dicke (F) jedes Fußbodenpaneels (1) größer oder gleich 5 mm ist.
- 35 17. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Fußbodenpaneelle (1) aus länglichen Paneelen bestehen und dass sie zumindest an ihren Längsseiten (2-3) mit den vorerwähnten Kupplungsteilen (4-5) versehen sind.
- 40 18. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Fußbodenpaneelle (1) rechteckig oder quadratisch sind und dass sie an allen vier Seiten (2-3-26-27), spezieller zwei zu zwei, mit den vorerwähnten Kupplungsteilen (4-5-28-29) versehen sind.
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19. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Kupplungssteile (4-5, 28-29) zumindest zweier gegenüberliegender Seiten (2-3, 26-27) derart verwirklicht sind, dass die Fußbodenpaneelle (1) sowohl durch ein Ineinanderschieben als auch mittels einer Drehbewegung zusammengefügt werden können, wobei, während des Zusammenfügens mittels der Drehbewegung, eine Verbiegung in den Kupplungssteilen (4-5 und/oder 28-29) auftreten kann, welche Verbiegung weniger deutlich, wenn nicht sogar nicht vorhanden, ist im Vergleich zu der Verbiegung, die auftritt, wenn die Fußbodenpaneelle (1) mittels Ineinanderschieben zusammengefügt werden.
20. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Unterseite des vorerwähnten Vorsprungs von zumindest zwei Bereichen (38-40, 75-76) begrenzt wird, beziehungsweise einem Bereich (38-75) mit einer starken Neigung, der für den Verriegelungseffekt sorgt, und einem Bereich (40-76) mit einer geringeren Neigung, der das Ineinanderfügen der Kupplungssteile (4-5) erleichtert.
21. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Tangente (L) einen Winkel (A) mit der Unterseite (7) der Fußbodenpaneelle bildet, der  $30^\circ$  bis  $70^\circ$  beträgt.
22. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Verriegelungsmittel (6) von Verriegelungselementen (34) gebildet werden, die sich vollständig in demjenigen Bereich der unteren Lippe (23-43) befinden, der sich über die obere Lippe (22-42) hinaus erstreckt, derart, dass der unterste Punkt (87) des Ineinandergreifens der Verriegelungselemente (34) sich unter der oberen Schicht des Fußbodenpaneels (1), das die betreffende Feder (9) trägt, befindet.
23. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Unterseite besagten Federbereichs, der sich von der Federspitze nach innen erstreckt, mit einer Krümmung (77) versehen ist.
24. Fußbodenbelag gemäß Anspruch 23, dadurch gekennzeichnet, dass besagte Krümmung (77) das freie Einfügen der Feder (9) in die Nut (10) mittels einer Drehbewegung um die Oberkante (16) des die Nut (10) aufweisenden Fußbodenpaneels (1) gestattet.
25. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass eine Krümmung (78) an der Oberseite der unteren Lippe (23-43) vorliegt, die beim Ineinanderschwenken zweier Fußbodenpaneelle (1) eine Führung bildet.
- 5     26. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass Staubkammern oder ähnliches (21-44-81) zwischen allen Seiten der zusammengefügten Fußbodenpaneelle (1), die seitwärts aufeinander zu gerichtet sind, vorgesehen sind.
- 10     27. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Formgebung der Feder (9-31) und/oder der unteren Lippe (43) derart ist, dass die Fußbodenpaneelle (1) gekoppelt werden können, indem sie seitwärts ineinandergeschoben werden, ausgehend von einer Position in Bezug zueinander, worin die Fußbodenpaneelle (1) an den zusammenzufügenden Kanten vollständig voneinander getrennt sind.
- 15     28. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass, wenn die Fußbodenpaneelle (1) aufeinander zu geschoben werden, die Oberseite der Federspitze sich bereits beim ersten Kontakt mit der oberen Lippe (42) unter der oberen Lippe (42) befindet.
- 20     29. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die untere Lippe (43) an ihrem freien Ende mit einer Anlauffläche (41-83) versehen ist, wobei besagte Anlauffläche (41-83) es gestattet, dass ein erstes Fußbodenpaneel (1), wenn es über den Boden zu einem zweiten Fußbodenpaneel (1) geschoben wird, mit seinem Vorsprung über besagte Anlauffläche geführt wird.
- 25     30. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass in der Eingriffsrichtung außer besagten Kontaktflächen (39-73) nur ein bedeutender Kontaktpunkt zwischen zwei gekoppelten Fußbodenpaneelen (1) besteht, der von einem Bereich (84) an der Stelle der Oberseite der Fußbodenpaneelle (1) gebildet wird.
- 30     31. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass besagte Fußbodenpaneelle (1) mit Kontaktflächen (85-86), spezieller Anschlagflächen, versehen sind, die von der Oberseite der Feder (9-31) und der Oberseite der Nut gebildet werden, die über den größten Teil ihrer Länge parallel zu der von den Fußbodenpaneelen (1) definierten Ebene verlaufen.
- 35     32. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die untere Lippe (23-43) eine Dicke aufweist, die kleiner

- als die Dicke der oberen Lippe ist.

33. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die untere Lippe (23-43) flexibler als die obere Lippe (22-42) ist. 5

34. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Unterseite der oberen Lippe (22-42) mit einer Abschrägung (24-45) versehen ist. 10

35. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Kontaktflächen (39-73) sich auf Radien (R1-R2) um die Oberkanten (15-16) herum befinden, wobei die Differenz zwischen diesen Radien (R1-R2) Null oder nicht größer als 2 mm ist. 15

36. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Oberseite der unteren Lippe (43) und/oder die Unterseite (12) der Feder einen Bereich aufweist, der eine Krümmung hauptsächlich mit einem Radius (R1, beziehungsweise R2) hat, wobei besagte Krümmung ein Zentrum hat, das sich innerhalb des Kreises (C1, beziehungsweise C2) befindet, der sich mit einem Radius (R5) von 3 mm um die Oberkante (15-16) des betreffenden Paneels (1) erstreckt. 20

37. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Oberseite der oberen Lippe (22-42) sich in derselben Ebene wie die Oberfläche des Paneels (1) befindet. 25

38. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass der sich über die obere Lippe (22-42) hinaus erstreckende Bereich der oberen Lippe (23-43) sich vollständig unter dem von der Unterseite der oberen Lippe (22-42) definierten Niveau befindet. 30

39. Fußbodenbelag gemäß Anspruch 38, dadurch gekennzeichnet, dass besagter Bereich der unteren Lippe sich vollständig unter der Mittellinie M2 des Paneels befindet. 35

40. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Feder (9) und Nut (10) das Zusammenfügen der Paneele (1) durch eine Drehbewegung um die Oberkanten (15-16) der Paneele (1) gestatten, wobei während dieser Bewegung die Feder frei in die Nut (10) geschoben werden kann. 40

41. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Paneele (1) Schmalseiten und Längsseiten aufweisen und dass die Verriegelungsmittel (6) Kontaktflächen aufweisen, die an den Schmalseiten eine stärkere Neigung als an den Längsseiten haben. 45

42. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Feder (9-31) und die Nut (10-32) ein Profil aufweisen, das durch Fräsen gefertigt werden kann, vorzugsweise durch Fräsen mit einem Durchmesser, der zumindest 20 Mal größer ist als die Dicke (F) der Fußbodenpaneele (1). 50

43. Fußbodenbelag gemäß Anspruch 42, dadurch gekennzeichnet, dass die Kanten der Paneele ein Profil aufweisen, das in zwei Fräsgänge gefräst werden kann. 55

44. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die untere Lippe einen geneigten Bereich (39-73) aufweist, der sich derart erstreckt, dass der Abstand (X1-X2) bis zur Oberkante (16) des Fußbodenpaneels (1) sich von unten in Aufwärtsrichtung verringert. 60

45. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Fußbodenpaneele (1) als Laminatfußboden verwirklicht sind, wobei auf dem Kern (8) eine oder mehrere Lagen, worunter eine dekorative Schicht (55), die besagte dekorative Oberfläche bildet, angebracht sind und wobei an der Unterseite (7) eine Rückenschicht (58) angebracht ist. 65

46. Fußbodenbelag gemäß einem der Ansprüche 1 bis 41, dadurch gekennzeichnet, dass die Kupplungssteile an ihrer Oberfläche, mit anderen Worten, den Kanten der Fußbodenpaneele (1), mit einem Oberflächenverdichter, spezieller einem Oberflächenhärter, behandelt sind. 70

47. Fußbodenbelag gemäß einem der vorgenannten Ansprüche, dadurch gekennzeichnet, dass die Fußbodenpaneele (1) leimfrei miteinander verbunden sind, so dass sie auseinandergenommen und wiederverwendet werden können. 75

48. Fußbodenpaneel zur Verwirklichung eines Fußbodenbelags gemäß einem der Ansprüche 1 bis 47. 80

49. Verfahren zur Herstellung von Fußbodenpaneelen, wie in einem der vorgenannten Ansprüche beschrieben, dadurch gekennzeichnet, dass die Feder (9-31) und/oder Nut (10-32) mittels eines Fräsprozesses mit zumindest zwei aufeinanderfolgenden Fräsgängen mittels Fräsen

- (63-64-65-66-67-68-69-70), die in Bezug zu dem betreffenden Fußbodenpaneel (1) in verschiedenen Winkeln positioniert sind, verwirklicht ist.
50. Verfahren gemäß Anspruch 49, dadurch gekennzeichnet, dass während jedes der vorerwähnten Fräsgänge jedesmal hauptsächlich die endgültige Form einer Flanke (71-72), entweder der Feder oder der Nut, verwirklicht wird. 5
51. Verfahren gemäß Anspruch 49 oder 50, dadurch gekennzeichnet, dass für die zwei vorgenannten Fräsgänge Fräsen (63-64-65-66-67-68-69-70) verwendet werden, die sich außerhalb der Nut (10-32) beziehungswise der Feder (9-31) erstrecken und spezieller Durchmesser (G) aufweisen, die zumindest 5 Mal größer als die Dicke (F) der Fußbodenpaneele (1) ist, und vorzugsweise sogar zumindest 20 Mal größer als die Dicke (F) der Fußbodenpaneele (1). 10
52. Verfahren gemäß einem der Ansprüche 49 bis 51, dadurch gekennzeichnet, dass an allen vier Seiten des Fußbodenpaneels (1) ein Profil angebracht ist und dass die Fußbodenpaneele (1) gemäß zweier rechtwinkliger Bewegungen (V1-V2) bewegt werden, wobei während einer der Bewegungen Profile an zwei gegenüberliegenden Kanten angebracht werden und während der anderen Bewegung Profile an den Schmalseiten angebracht werden. 15
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- (22-42);  
 - les éléments d'accouplement sont munis de moyens de verrouillage mécaniques intégrés (6) réalisés en une seule pièce avec ladite partie centrale, qui empêchent l'écartement réciproque de deux panneaux de sol accouplés l'un à l'autre, dans une direction perpendiculaire au bord correspondant et dans une direction parallèle au côté inférieur des panneaux de sol accouplés l'un à l'autre;  
 - lesdits moyens de verrouillage mécaniques intégrés comprennent d'une part une saillie (33) disposée sur la surface inférieure (35) de ladite languette, ladite saillie s'étendant au moins en partie au-delà dudit plan vertical vers l'intérieur et ladite saillie possédant une surface de contact (38, 74), et d'autre part, un évidement (36) pratiqué dans la lèvre inférieure, dans lequel vient se loger ladite saillie, ledit évidement possédant une surface de contact (39, 73) coopérant avec ladite surface de contact de ladite saillie de telle sorte qu'une ligne tangente (L) qui est définie par lesdites surfaces de contact lors de leur mise en contact réciproque est inclinée par rapport auxdits plans horizontaux;  
 - ladite surface de contact (39, 73) de la lèvre inférieure est située au moins en partie dans la partie de la lèvre inférieure (23-43) s'étendant au-delà de la lèvre supérieure; et  
 - ladite saillie (33), ledit évidement (36) et ladite lèvre inférieure (23-43) élastiquement pliable sont arrangées pour permettre la jonction desdits panneaux en les déplaçant l'un par rapport à l'autre d'une manière essentiellement plane.

### Revendications

1. Recouvrement de sol constitué par des panneaux de sol durs comprenant une partie centrale à base de bois, lesdits panneaux (1) étant conçus pour être posés de façon à obtenir une surface plate orientée vers le haut, disposée dans un premier plan horizontal, et une surface essentiellement plate orientée vers le bas, disposée dans un second plan horizontal, lesdits panneaux de sol durs étant munis, au moins aux bords de deux côtés opposés (2-3, 26-27), d'éléments d'accouplement (4-5, 28-29) réalisés en une seule pièce avec ladite partie centrale à base de bois et coopérant les uns avec les autres, essentiellement sous la forme d'une languette (9-31) et d'une rainure (10-32), ladite rainure étant au moins délimitée par une lèvre supérieure (22-42) se terminant dans un plan vertical et par une lèvre inférieure (23-43), ladite languette possédant une partie de languette s'étendant depuis l'extrémité de la languette vers l'intérieur jusqu'au dit plan vertical lorsque lesdits panneaux sont joints, dans lequel:
  - la lèvre inférieure (23-43) est élastiquement pliable et s'étend au-delà de la lèvre supérieure
2. Recouvrement de sol selon la revendication 1, caractérisé en ce que la partie centrale à base de bois des panneaux de sol (1) comprend un produit de bois broyé qui, conjointement avec un liant, forme un seul composé et/ou est réalisé à partir d'un panneau d'agglomérés avec des copeaux finement découpés.
3. Recouvrement de sol selon la revendication 1 ou 2, caractérisé en ce que la partie centrale à base de bois des panneaux de sol (1) est constituée de panneau HDF ou de panneau MDF, les éléments d'accouplement (4-5-28-29) et les moyens de verrouillage (6) étant réalisés à partir de ce panneau.
4. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce qu'au moins la surface de contact (39-73) formée à la lèvre inférieure (23-43) est inclinée vers l'intérieur.
5. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que

- les deux surfaces de contact (38-39, 73-74) sont inclinées.
6. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que ladite saillie possède une base s'étendant le long de la surface inférieure (35) de ladite languette sur une longueur considérable.
7. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que l'épaisseur de la lèvre inférieure (23-43) augmente depuis le point le plus profond de l'évidement jusqu'au point le plus interne de la rainure (10).
8. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la languette (9-31) et la rainure (10-32) possèdent une forme telle qu'à l'état accouplé de deux panneaux de sol (1), on obtient une chambre (81) entre les côtés de la saillie et de l'évidement (36) qui sont opposés aux côtés auxquels sont formées les surfaces de contact (39-73).
9. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les éléments d'accouplement (4-5, 28-29) procurent un verrouillage réciproque permettant d'accoupler les panneaux en l'absence de jeu les uns par rapport aux autres dans toutes les directions du plan qui est perpendiculaire aux bords susmentionnés.
10. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens de verrouillage (6) sont construits de telle sorte qu'en exerçant une pression par-dessus un panneau (1) à proximité du bord qui est muni de la languette (9-31), ces moyens de verrouillage (6) ont tendance à presser les panneaux de sol (1) l'un en direction de l'autre.
11. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce qu'on prévoit un espace (S, 81) entre ladite saillie et une partie de ladite lèvre inférieure (43), plus particulièrement en dessous de ladite saillie, permettant une pénétration ultérieure de la saillie dans l'évidement en cas de nécessité.
12. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les deux surfaces de contact (12-14, 38-39, 74-73) sont inclinées et possèdent des inclinaisons correspondantes.
13. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que qu'au moins une des surfaces de contact (73-74) est constituée d'une surface plate inclinée précédée, dans la direction d'insertion de la languette dans la rainure, d'un arrondi (80-79) à une extrémité externe de ladite surface inclinée.
14. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les éléments d'accouplement (4-5, 28-29) possèdent une forme telle que deux panneaux de sol successifs (1) peuvent s'insérer l'un dans l'autre en les déplaçant latéralement de manière conjointe tout en les faisant tourner.
15. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la distance (E), sur laquelle la lèvre inférieure s'étend au-delà de la lèvre supérieure, est inférieure à une fois l'épaisseur totale (F) du panneau de sol (1).
16. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que l'épaisseur totale (F) de chaque panneau de sol (1) est supérieure ou égale à 5 mm.
17. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les panneaux de sol (1) sont constitués par des panneaux allongés et en ce que, au moins sur leurs côtés longitudinaux (2-3), ils sont munis des éléments d'accouplement (4-5) susmentionnés.
18. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les panneaux de sol (1) sont rectangulaires ou carrés et en ce que, sur l'ensemble de leurs quatre côtés (2-3, 26-27), plus particulièrement deux par deux, ils sont munis des éléments d'accouplement susmentionnés (4-5, 28-29).
19. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les éléments d'accouplement (4-5, 28-29) d'au moins deux côtés opposés (2-3, 26-27) sont réalisés de telle sorte que les panneaux de sol (1) peuvent être insérés en les déplaçant l'un en direction de l'autre, ainsi qu'à l'aide d'un mouvement de rotation, si bien qu'au cours de l'insertion à l'aide du mouvement de rotation, un pliage peut avoir lieu dans les éléments d'accouplement (4-5 et/ou 28-29), ledit pliage étant moins prononcé, voire inexistant par rapport au pliage qui se produit lorsque les panneaux de sol (1) sont insérés en les déplaçant les uns en direction des autres.
20. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que

- la surface inférieure de la saillie susmentionnée est délimitée par au moins deux parties (38-40, 75-76), respectivement une partie (38-75) de forte inclinaison procurant l'effet de verrouillage et une partie (40-76) d'inclinaison plus faible qui rend l'insertion des éléments d'accouplement (4-5) plus facile.
21. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la ligne tangente (L) forme un angle (A) avec le côté inférieur (7) des panneaux de sol, qui s'élève de 30 degrés à 70 degrés.
22. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens de verrouillage (6) sont formés par des éléments de verrouillage (34) qui sont situés complètement dans la partie de la lèvre inférieure (23-43) qui s'étend au-delà de la lèvre supérieure (22-42) de telle sorte que le point le plus bas (87) de mise en contact des éléments de verrouillage (34) est situé en dessous de la couche supérieure du panneau de sol (1) qui supporte la languette correspondante (9).
23. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que le côté inférieur de ladite partie de languette s'étendant depuis l'extrémité de languette vers l'intérieur est muni d'une courbure (77).
24. Recouvrement de sol selon la revendication 23, caractérisé en ce que ladite courbure (77) permet à la languette (9) de venir s'insérer librement dans la rainure (10) à l'aide d'un mouvement de rotation autour du bord supérieur (16) du panneau de sol (1) possédant la rainure (10).
25. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce qu'on prévoit une courbure (78) sur le côté supérieur de la lèvre inférieure (23-43), qui forme un guidage lorsqu'on fait tourner deux panneaux de sol (1) l'un dans l'autre.
26. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce qu'on prévoit des chambres de poussière ou analogues (21-44-81) entre tous les côtés des panneaux de sol insérés (1) qui sont orientés latéralement l'un en direction de l'autre.
27. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la configuration de la languette (9-31) et/ou de la lèvre inférieure (43) est telle que les panneaux de sol (1) peuvent être accouplés l'un à l'autre en les déplaçant latéralement l'un vers l'autre en partant

d'une position réciproque dans laquelle les panneaux de sol (1) aux bords à accoupler sont complètement séparés l'un de l'autre.

- 5    28. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que le côté supérieur de l'extrémité de languette, déjà lors du premier contact avec la lèvre supérieure (42) est disposé en dessous de la lèvre supérieure (42) lorsque les panneaux de sol (1) se déplacent l'un en direction de l'autre.
- 10    29. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la lèvre inférieure (43), à son extrémité libre, est munie d'une surface de rampe (41-83), ladite surface de rampe (41-83) permettant à un premier panneau de sol (1), lorsqu'il se déplace par-dessus le sol en direction d'un second panneau de sol (1), d'être guidé avec sa saillie par-dessus ladite surface de rampe.
- 15    30. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que, dans la direction-d'insertion, en dehors desdites surfaces de contact (39-73), un seul point de contact substantiel existe entre deux panneaux de sol (1) accouplés l'un à l'autre, qui est formé par une zone (84) à l'endroit correspondant au côté supérieur des panneaux de sol (1).
- 20    31. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que lesdits panneaux de sol (1) sont munis de surfaces de contact (85-86), plus particulièrement de surfaces de butée formées par le côté supérieur de la languette (9-31) et par le côté supérieur de la rainure (10), qui, sur la plus grande partie de leur longueur, s'étendent parallèlement au plan qui est défini par les panneaux de sol (1).
- 25    32. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que l'épaisseur de la lèvre inférieure (23-43) est inférieure à l'épaisseur de la lèvre supérieure.
- 30    33. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la lèvre inférieure (23-43) est plus flexible que la lèvre supérieure (22-42).
- 35    34. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que le côté inférieur de la lèvre supérieure (22-42) est muni d'un chanfrein (24-45).
- 40    35. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que
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- les surfaces de contact (39-73) sont situées sur des rayons (R1-R2) autour des bords supérieurs (15-16), la différence entre ces rayons R1-R2 étant égale à 0 ou n'étant pas supérieure à 2 mm.
36. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que le côté supérieur de la lèvre inférieure (43) et/ou le côté inférieur (12) de la languette présentent une partie possédant une courbure comprenant essentiellement un rayon (R1, respectivement R2), ladite courbure possédant un centre qui est situé à l'intérieur du cercle (C1, respectivement C2) qui s'étend avec un rayon (R5) de 3 mm autour du bord supérieur (15-16) du panneau (1) concerné. 5
37. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que le côté supérieur de la lèvre supérieure (22-42) se trouve dans le même plan que la surface supérieure du panneau (1). 10
38. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la partie de la lèvre inférieure (23-43) située au-delà de la lèvre supérieure (22-42) est disposée complètement en dessous du niveau défini par le côté inférieur de la lèvre supérieure (22-42). 15
39. Recouvrement de sol selon la revendication 38, caractérisé en ce que ladite partie de la lèvre inférieure est située complètement en dessous de la ligne centrale (M2) du panneau. 20
40. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la languette (9) et la rainure (10) permettent d'accoupler les panneaux (1) à l'aide d'un mouvement de rotation autour des bords supérieurs (15-16) des panneaux (1) de telle sorte qu'au cours de ce mouvement, la languette peut glisser librement dans la rainure (10). 25
41. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les panneaux (1) possèdent des petits côtés et des grands côtés et en ce que les moyens de verrouillage (6) comprennent des surfaces de contact qui, sur leurs petits côtés, possèdent une inclinaison plus marquée que sur leurs grands côtés. 30
42. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la languette (9-31) et la rainure (10-32) possèdent un profil qui peut être réalisé par fraisage de préférence à l'aide de fraises dont le diamètre est d'au moins 20 fois supérieur à l'épaisseur (F) des panneaux de sol (1). 35
43. Recouvrement de sol selon la revendication 42, caractérisé en ce que les bords des panneaux possèdent un profil qui peut être fraisé en deux opérations de fraisage. 5
44. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que la lèvre inférieure possède une partie inclinée (39-73) qui s'étend de telle sorte que la distance (X1-X2) jusqu'au bord supérieur (16) du panneau de sol (1) diminue à partir du bas vers le haut. 10
45. Recouvrement de sol selon l'une quelconque des revendications précédentes, caractérisé en ce que les panneaux de sol (1) sont réalisés sous la forme d'une structure de sol stratifiée, par lequel, sur la partie centrale (8), on prévoit une ou plusieurs couches parmi lesquelles une couche décorative (55) formant ladite surface décorative et par lequel on prévoit une couche dorsale (58) sur le côté inférieur (7). 15
46. Recouvrement de sol selon l'une quelconque des revendications 1 à 41, caractérisé en ce que les éléments d'accouplement, sur leurs surfaces, en d'autres termes, les bords des panneaux de sol (1) sont traités avec un agent de densification de surface, plus particulièrement un agent de durcissement de surface. 20
47. Recouvrement de sol selon l'une quelconque des revendications 1 à 47, caractérisé en ce que les panneaux de sol (1) sont reliés en l'absence de colle, si bien qu'ils peuvent être démontés et réutilisés. 25
48. Panneau de sol pour réaliser un recouvrement de sol selon l'une quelconque des revendications 1 à 47. 30
49. Procédé pour fabriquer des panneaux de sol comme décrit dans l'une quelconque des revendications précédentes, caractérisé en ce qu'on réalise la languette (9-31) et/ou la rainure (10-32) à l'aide d'un processus de fraisage avec au moins deux cycles de fraisage successifs à l'aide de fraises (63-64-65-66-67-68-69-70) qui sont disposées en formant des angles différents par rapport au panneau de sol correspondant (1). 35
50. Procédé selon la revendication 49, caractérisé en ce qu'au cours de chacun des cycles de fraisage susmentionnés, on réalise chaque fois essentiellement la configuration finale d'un flanc (71-72), soit de la languette, soit de la rainure. 40
51. Procédé selon la revendication 49 ou 50, caractérisé en ce que, pour les deux cycles de fraisage susmentionnés, on applique des fraises 45

(63-64-65-66-67-68-69-70) qui s'étendent à l'extérieur de la rainure (10-32), respectivement de la languette (9-31) et qui présentent plus particulièrement des diamètres (G) qui sont d'au moins 5 fois supérieurs à l'épaisseur (F) des panneaux de sol (1), de préférence qui sont même d'au moins 20 fois supérieurs à l'épaisseur (F) des panneaux de sol (1).

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52. Procédé selon l'une quelconque des revendications 10  
49 à 51, caractérisé en ce que l'ensemble des quatre côtés du panneau de sol (1) sont profilés et en ce que les panneaux de sol (1) sont déplacés conformément à deux mouvements perpendiculaires (V<sub>1</sub>-V<sub>2</sub>) par lesquels, au cours d'un des mouvements, on munit de profilés deux bords opposés, tandis qu'au cours de l'autre mouvement, on munit les petits bords de profilés.

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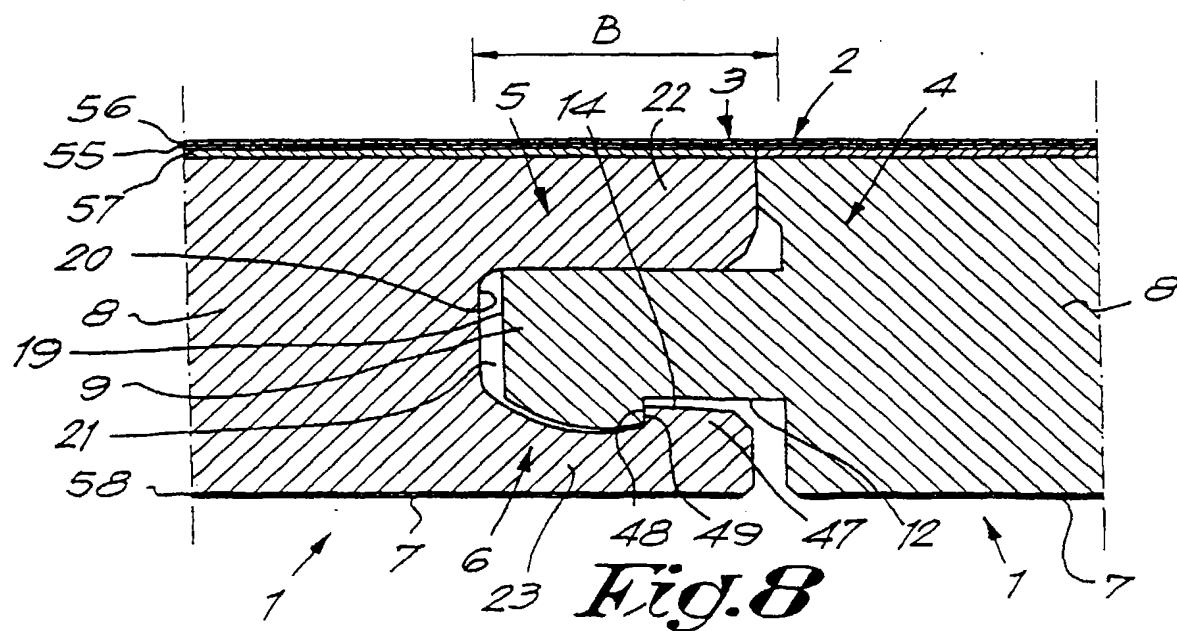
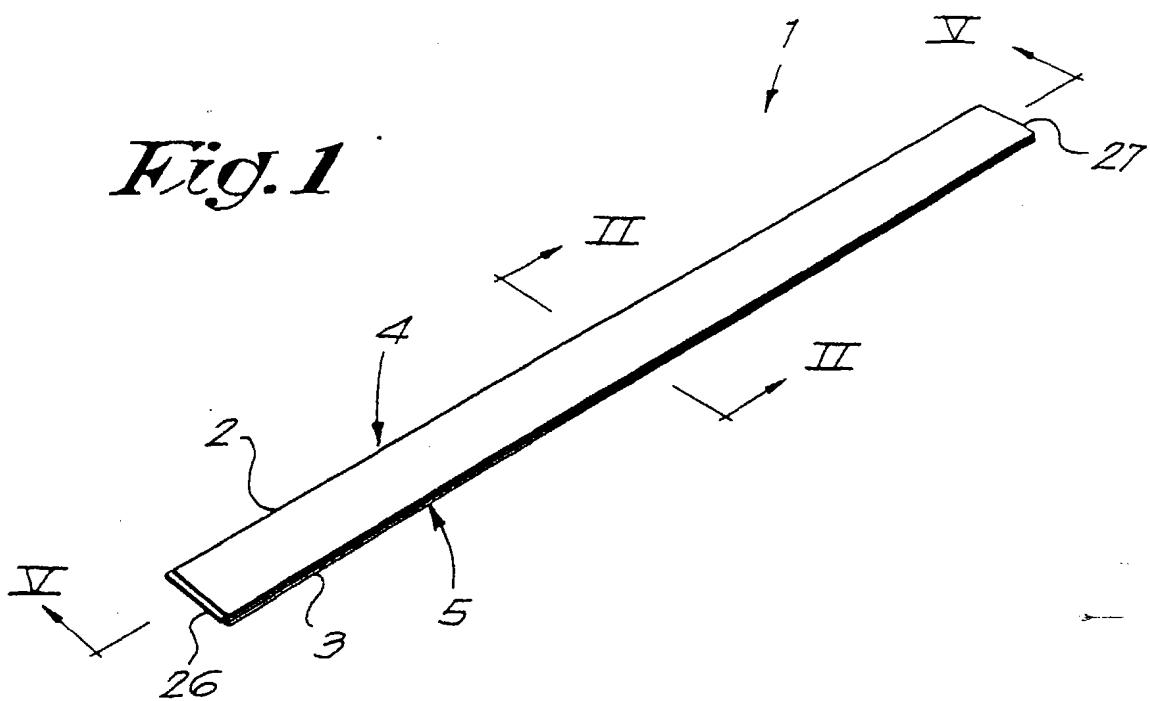
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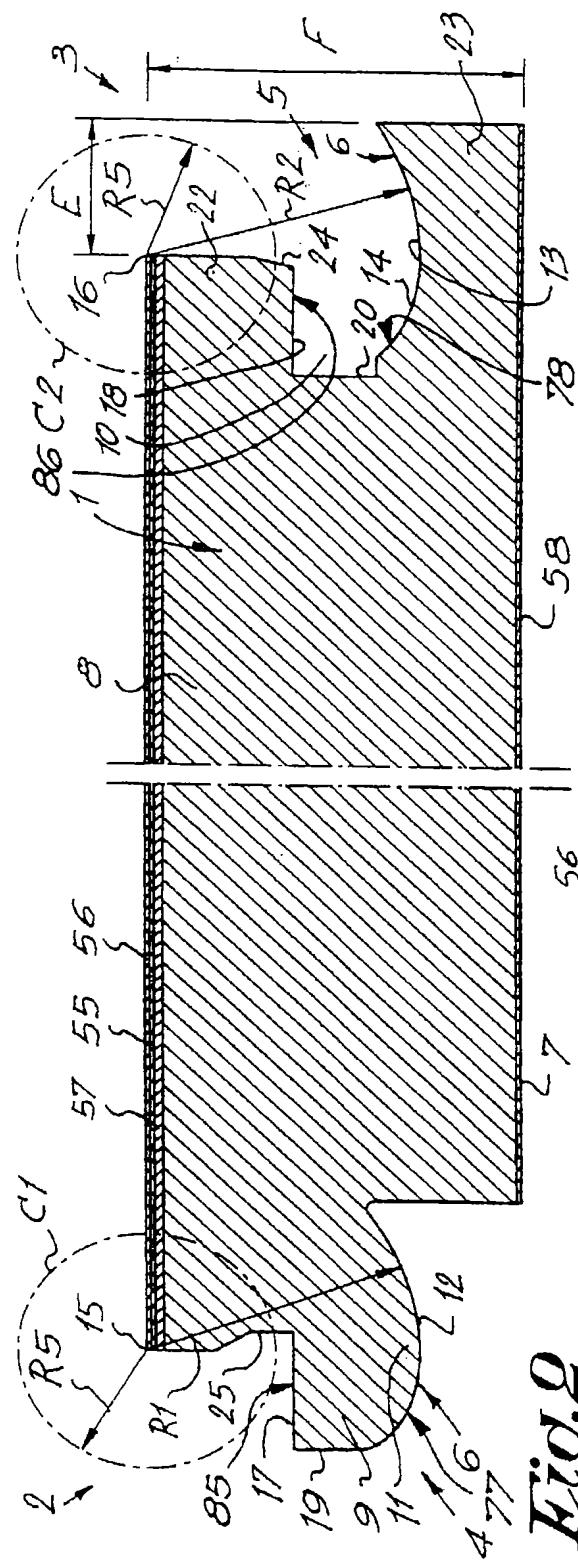
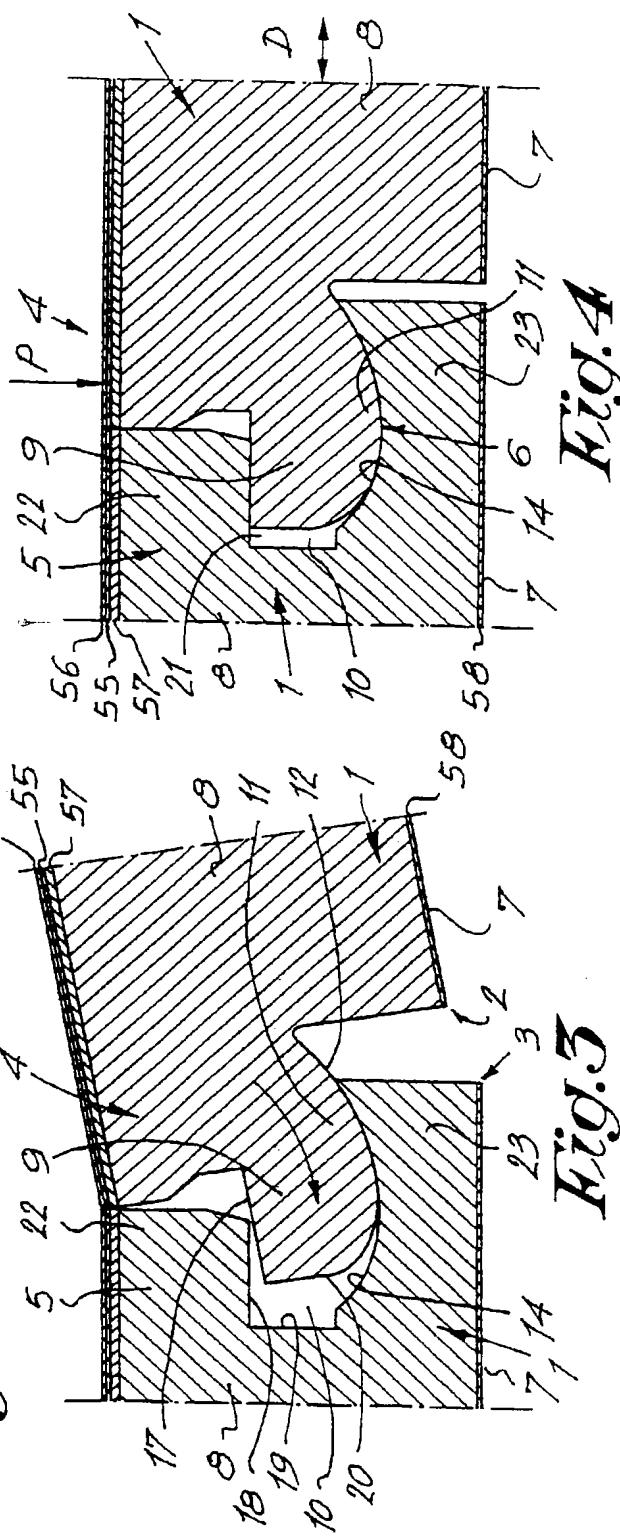
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*Fig. 1*

**Fig. 2****Fig. 3****Fig. 4**

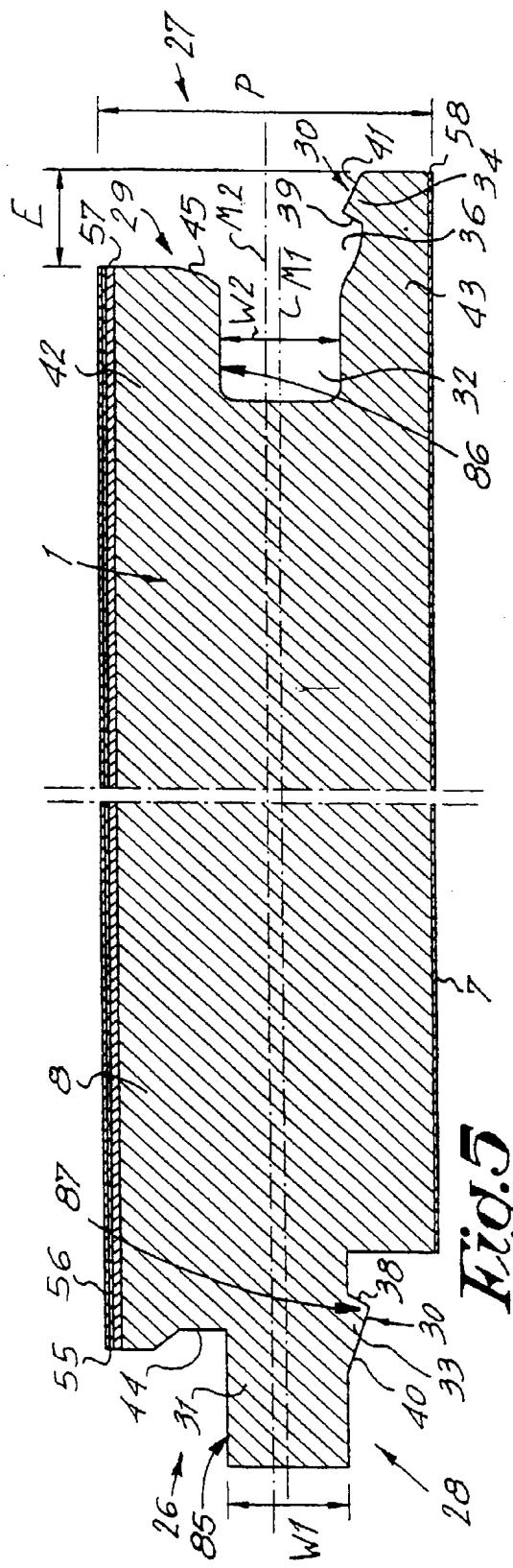
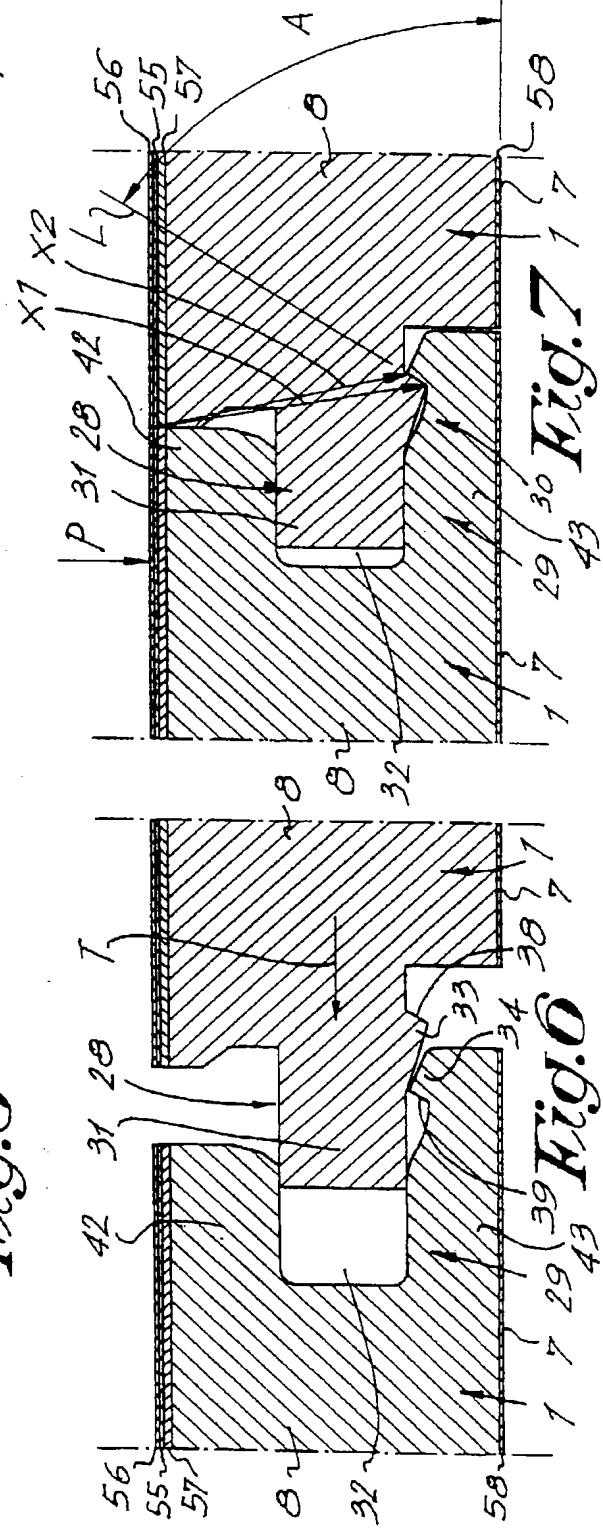
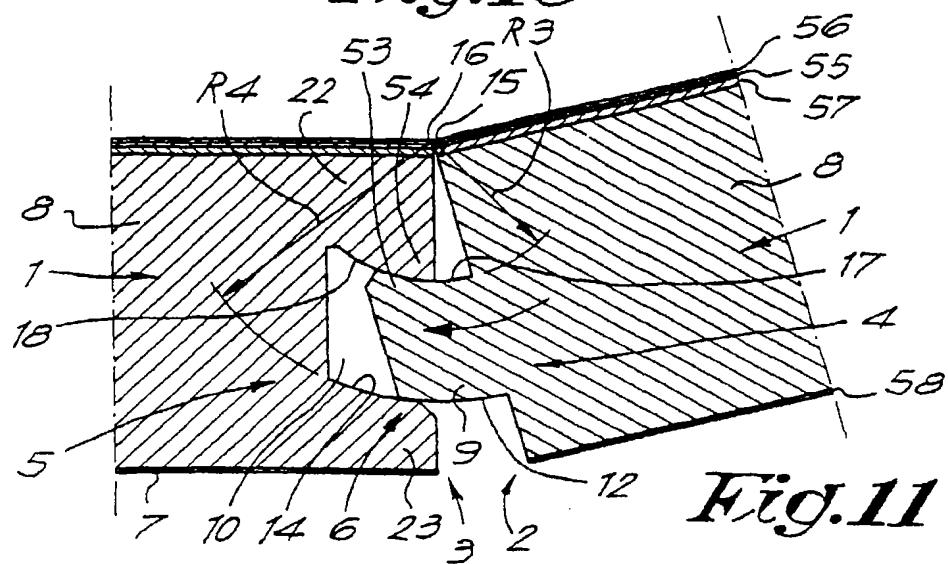
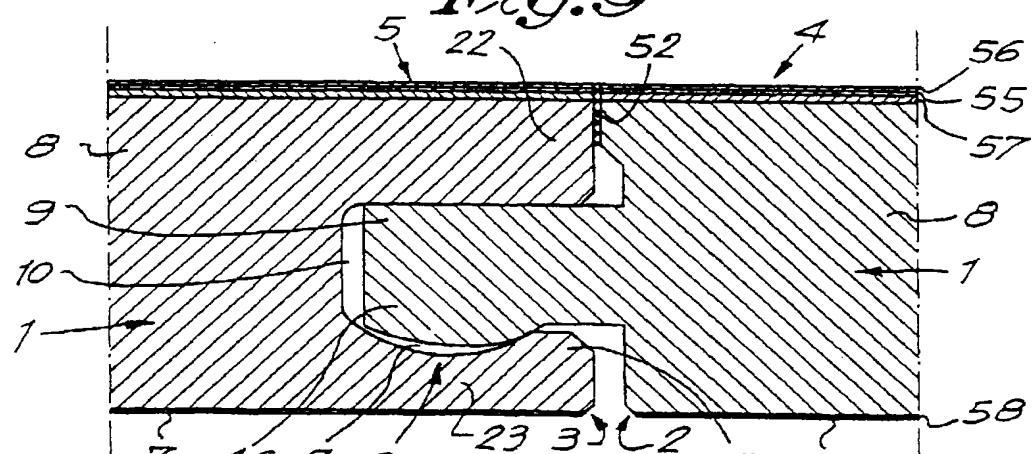
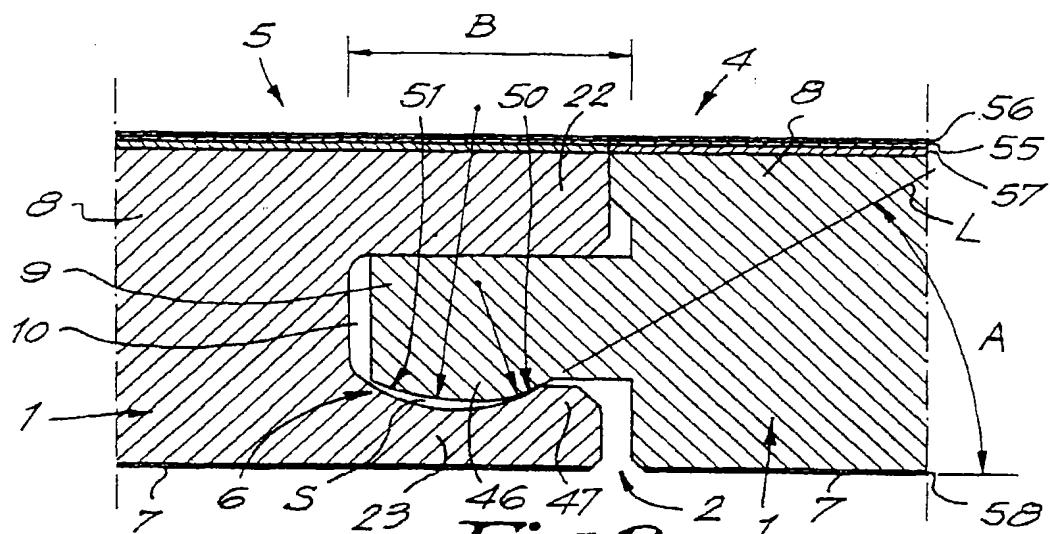


Fig. 5





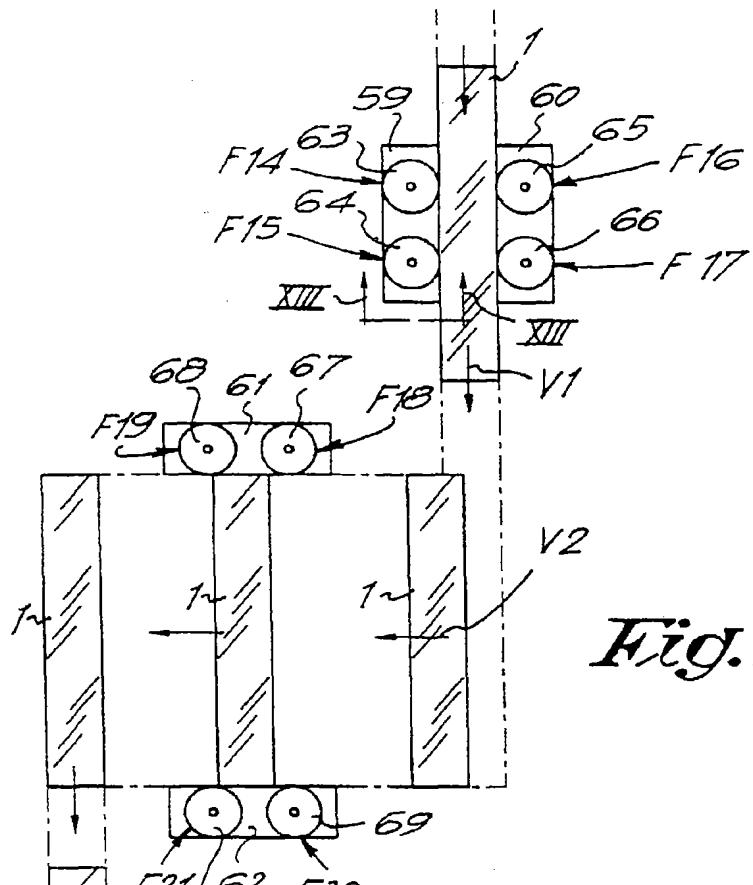


Fig. 12

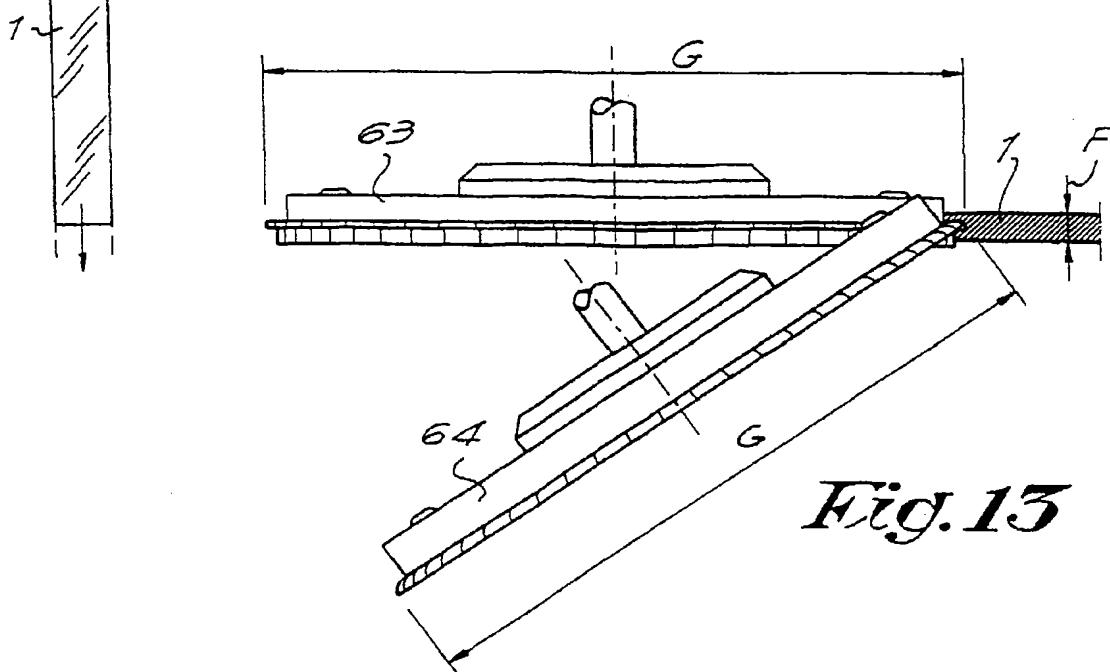
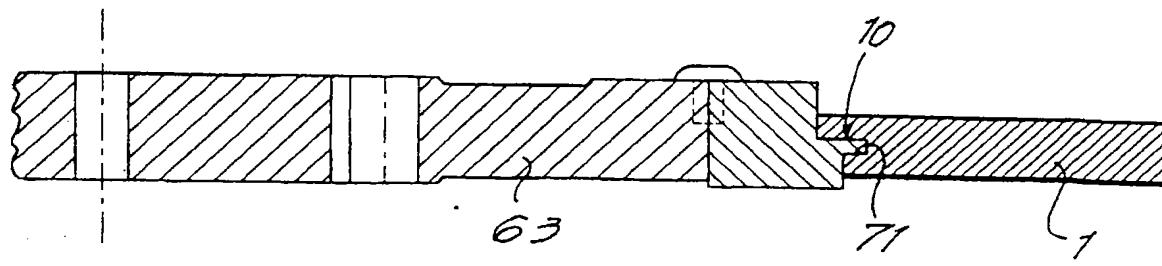
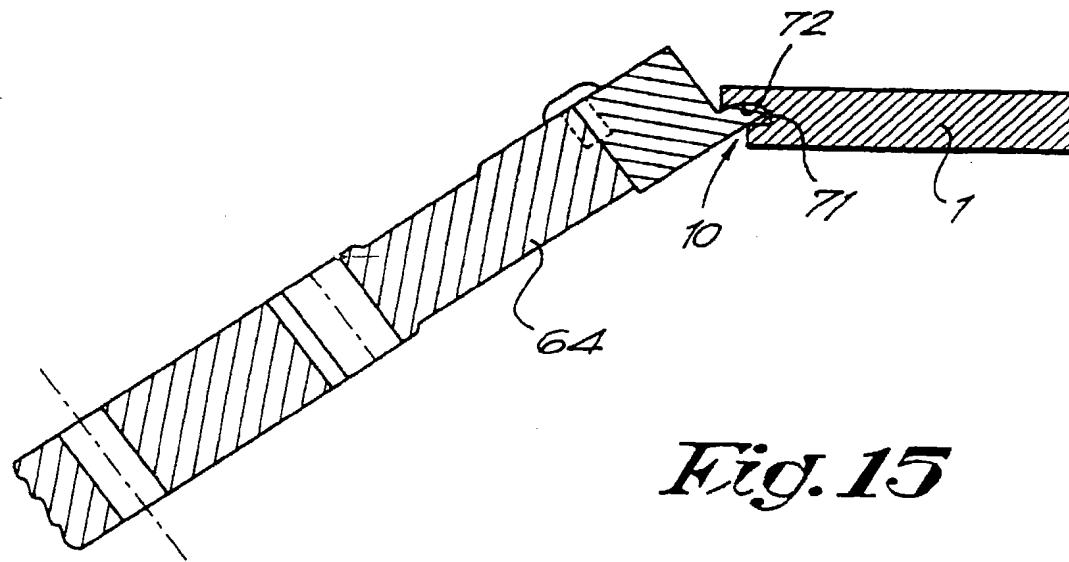


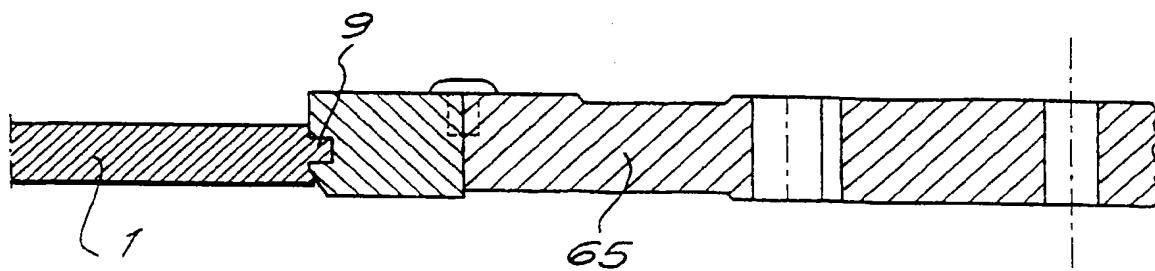
Fig. 13



*Fig. 14*

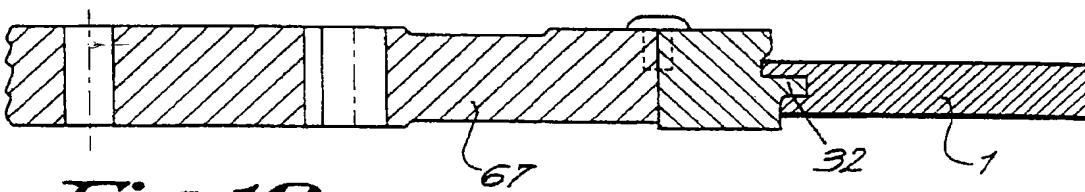
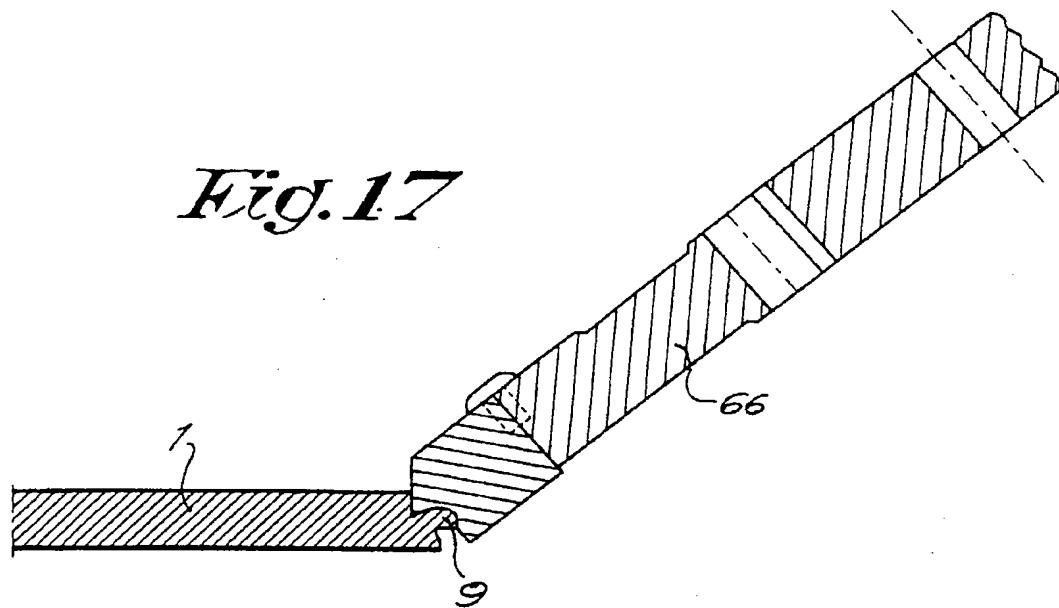


*Fig. 15*

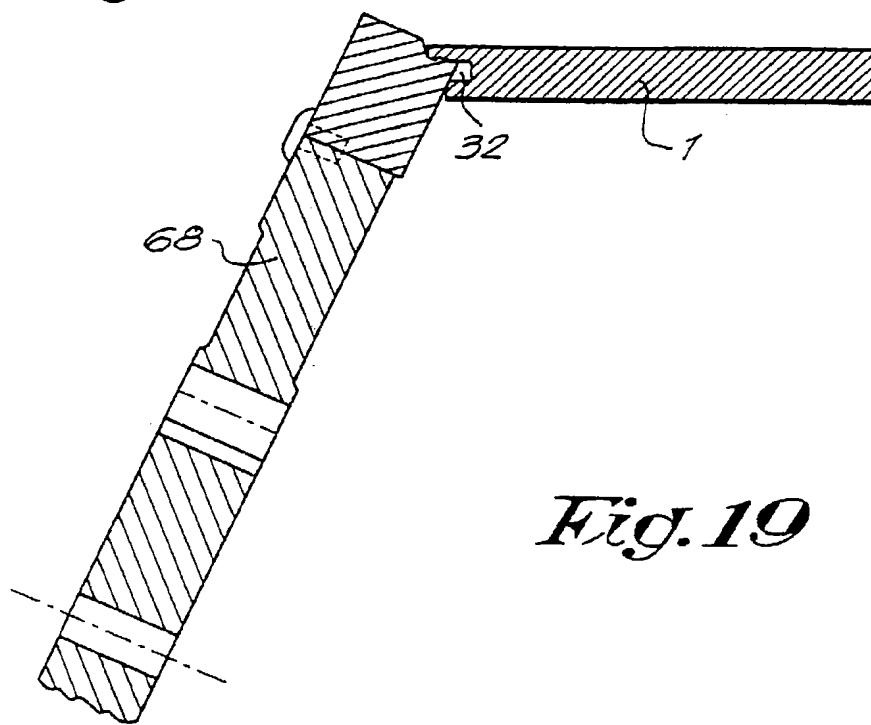


*Fig. 16*

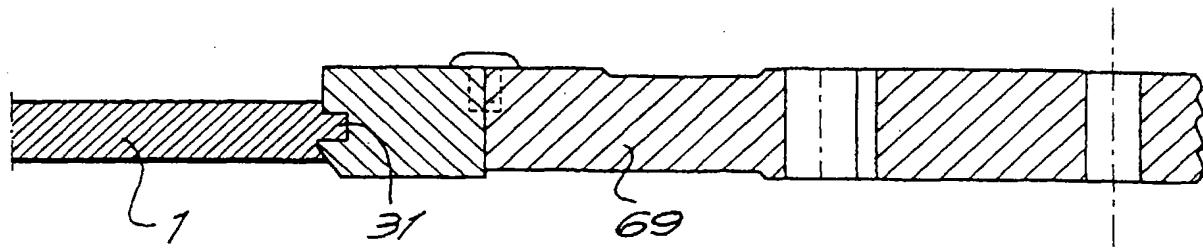
*Fig.17*



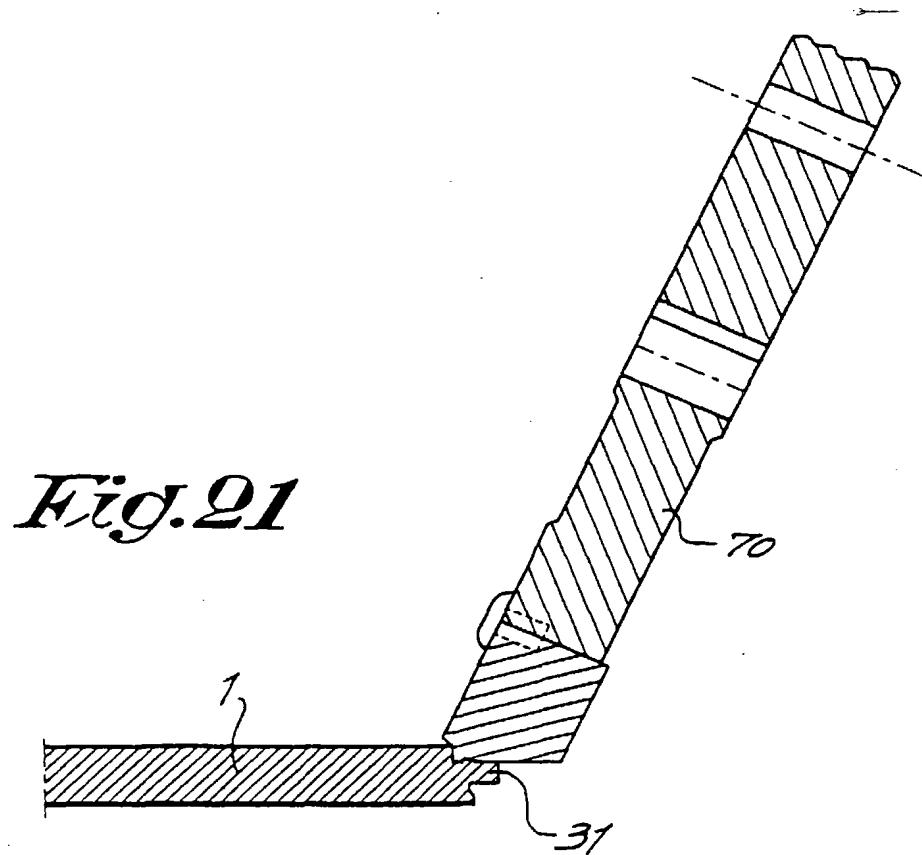
*Fig. 18*



*Fig. 19*



*Fig.20*



*Fig.21*

Fig. 22

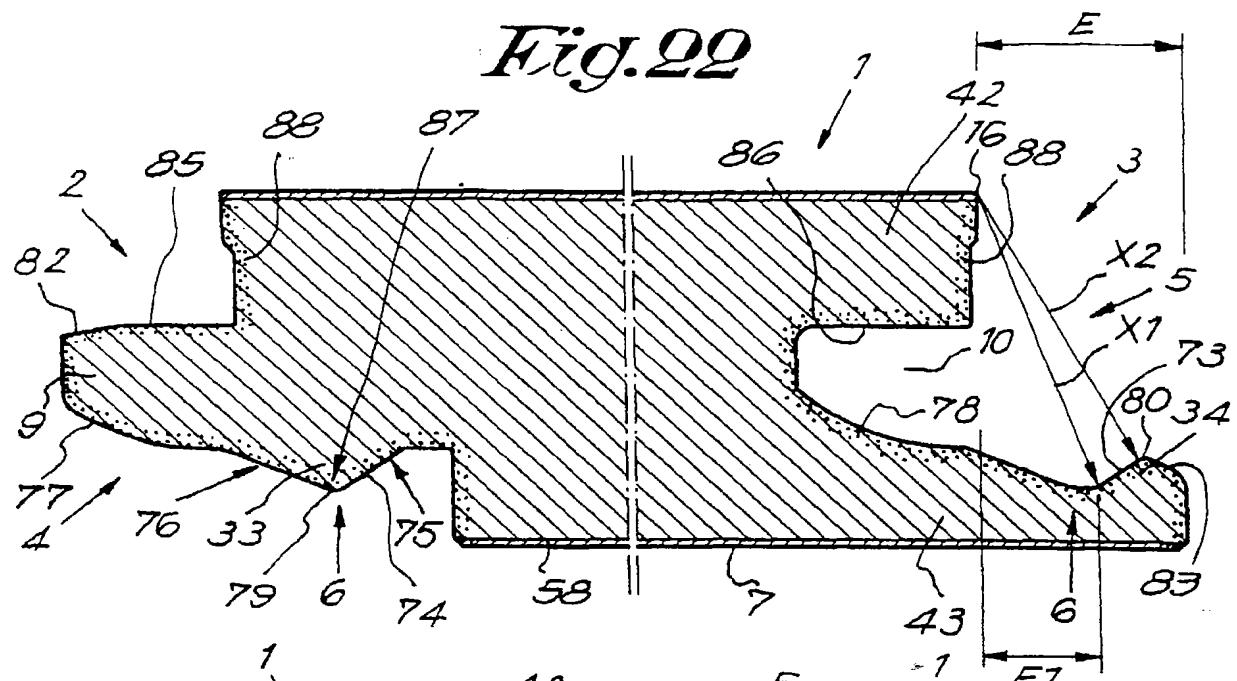


Fig. 23

